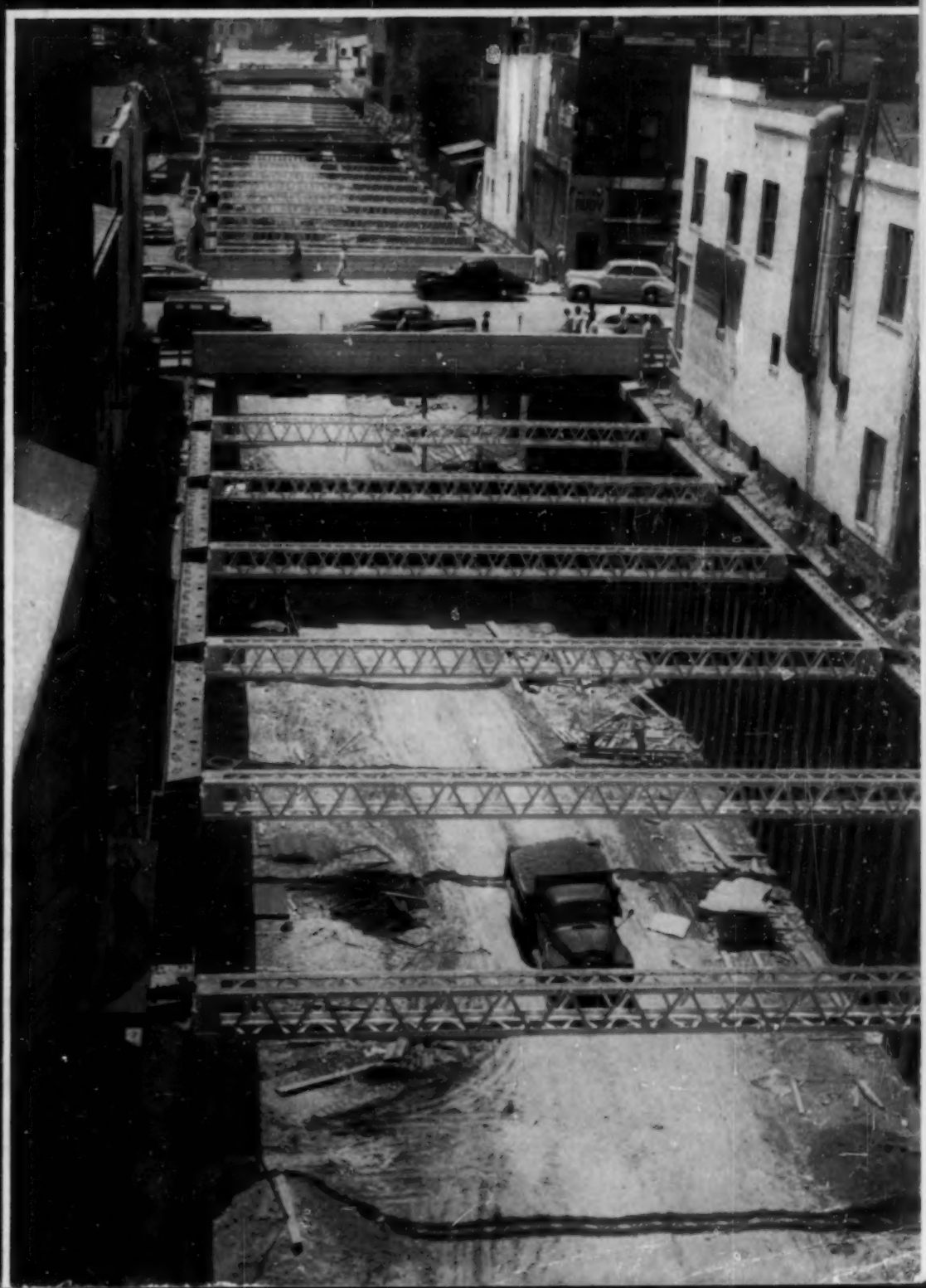
CIVIL ENGINEERING

THE MAGAZINE OF ENGINEERED CONSTRUCTION

nnel Driving Records Broken—Mason

Must Live With Atomic Radiation—Gorman

search Cuts Building Costs—Rassweiler



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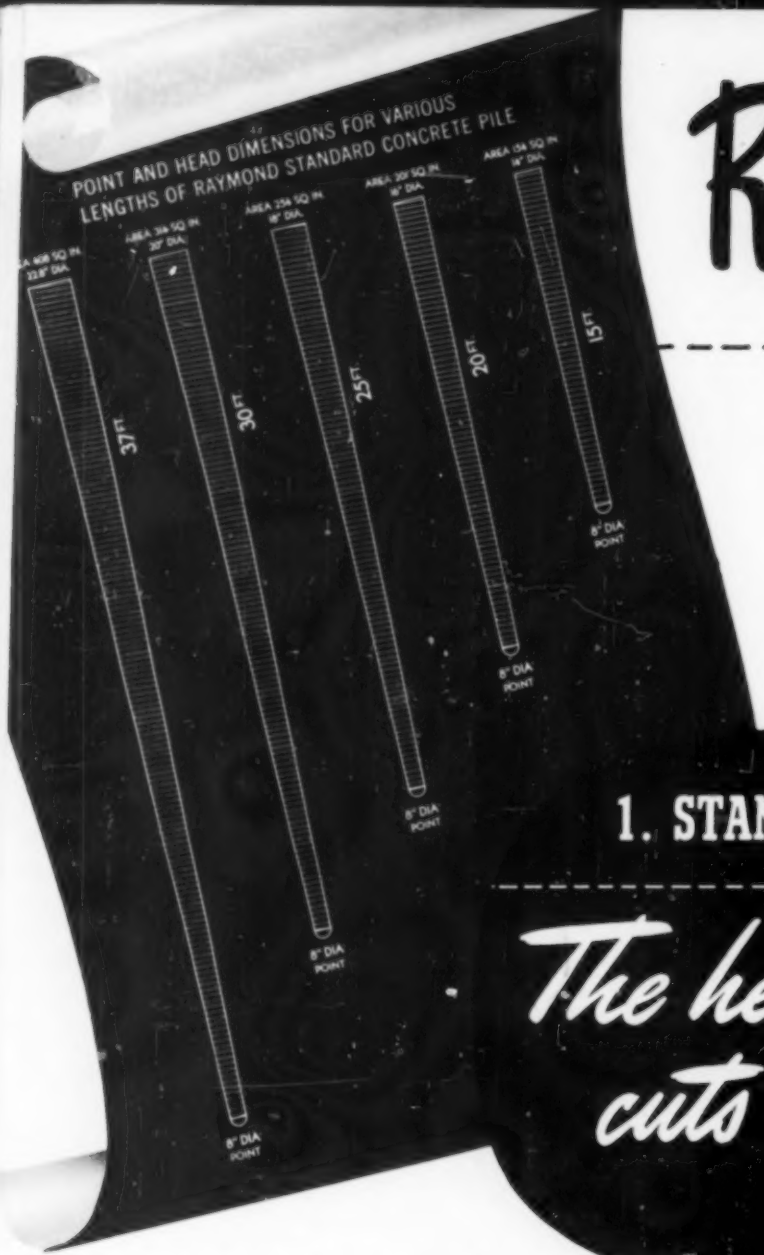

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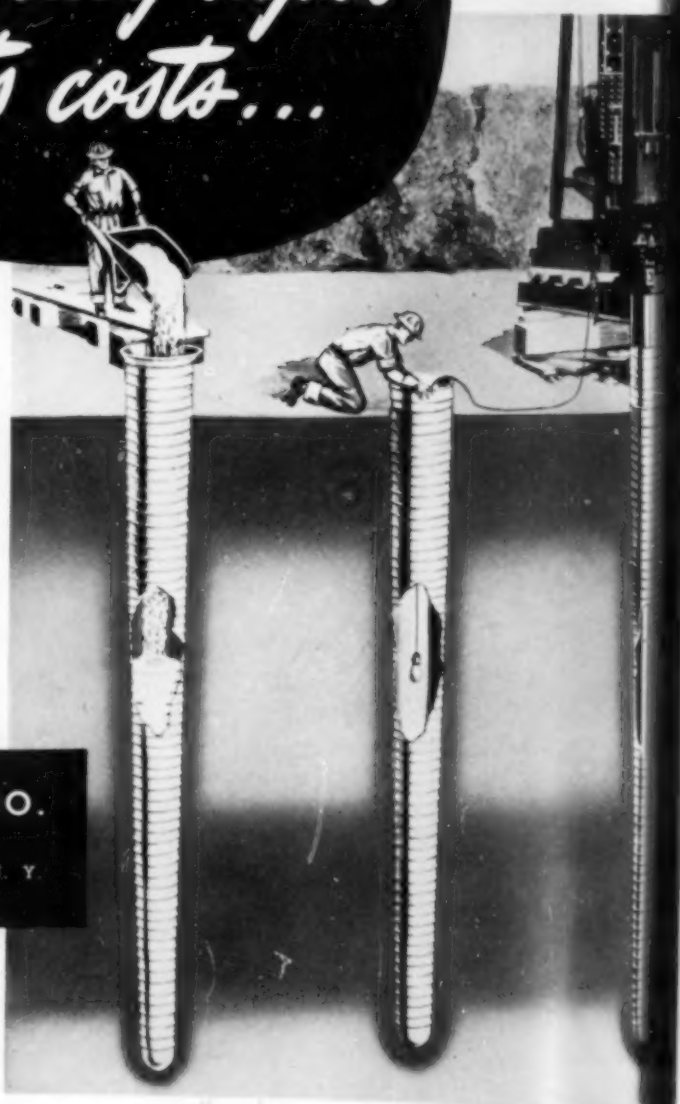

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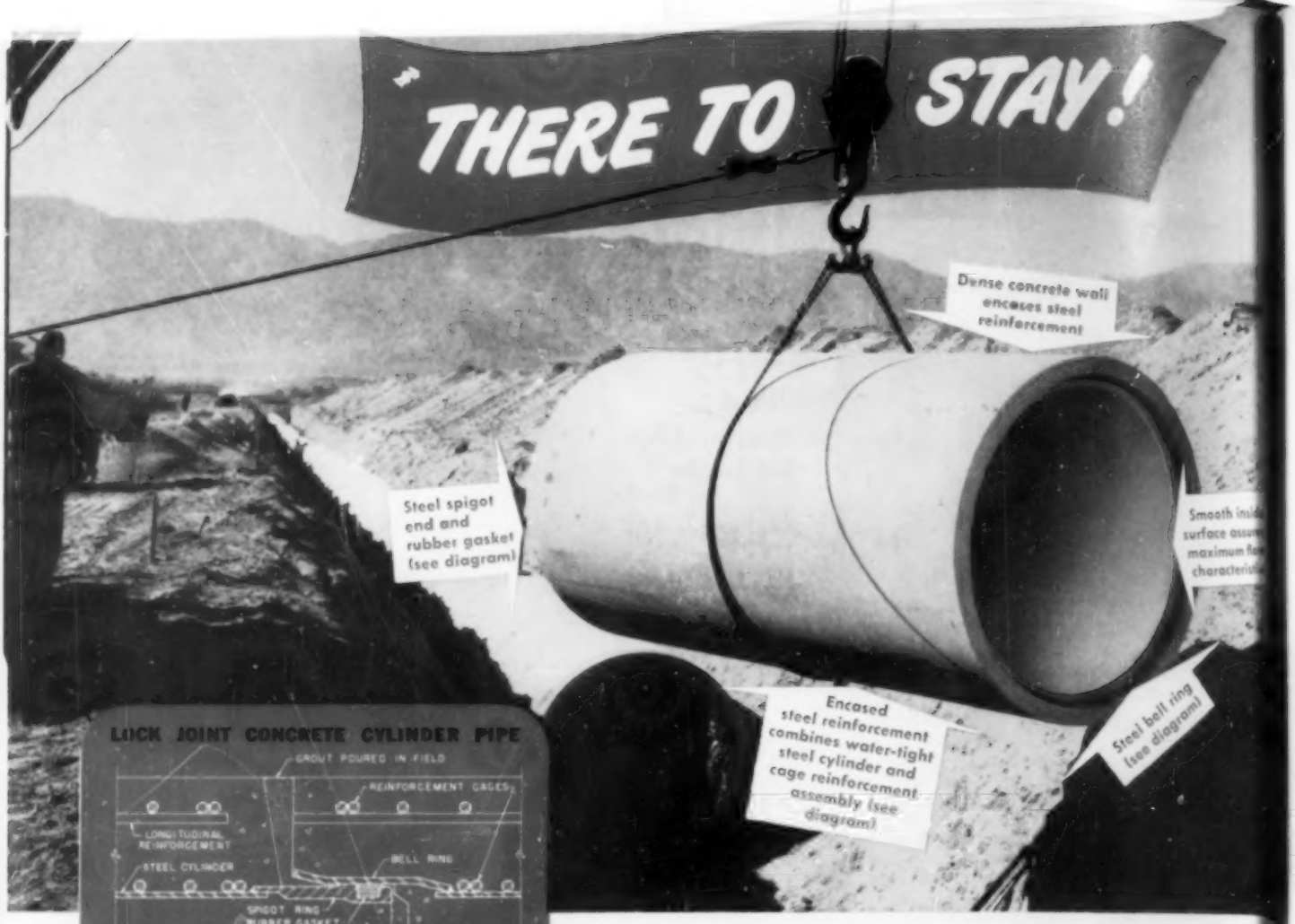
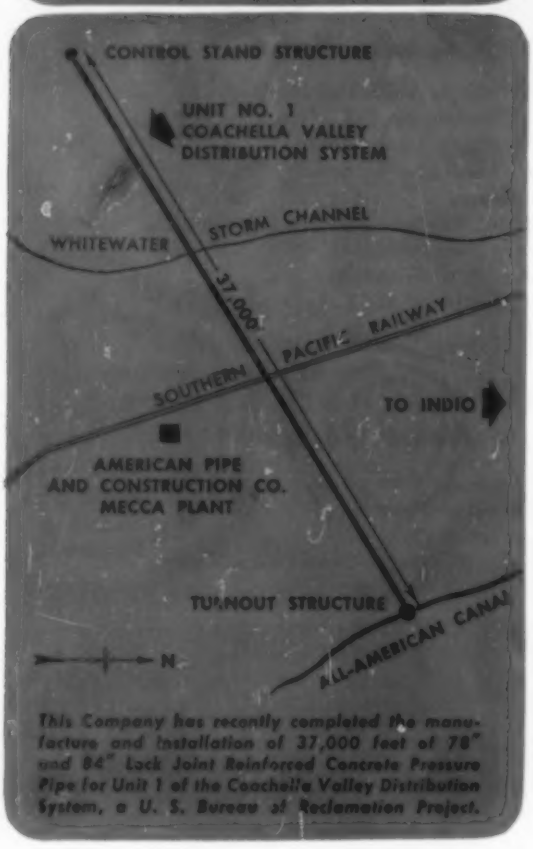

THERE TO STAY!
Dense concrete wall encases steel reinforcement
Steel spigot end and rubber gasket (see diagram)
Encased steel reinforcement combines water-tight steel cylinder and cage reinforcement assembly (see diagram)
Steel bell ring (see diagram)
LOCK JOINT CONCRETE CYLINDER PIPE
GROUT POURED IN FIELD
REINFORCEMENT CAGES
LONGITUDINAL REINFORCEMENT
STEEL CYLINDER
BELL RING
SPIGOT RING
RUBBER GASKET
INSIDE OF PIPE
MORTAR POINTING IN FIELD
Sizes 36" to 144" for heads of 150' and greater



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1950 Annual Meeting—New York, N.Y.

American Society of Civil Engineers

Hotel Commodore — Jan. 18–20, 1950

Registration: Ballroom Foyer, Commodore Hotel, 9:00 a.m., Wednesday, January 18

Ninety-Seventh Annual Business Meeting, Wednesday, January 18

10:00 A.M., GRAND BALLROOM, COMMODORE HOTEL

Presiding: Franklin Thomas, President, American Society of Civil Engineers

10:00 **Annual Reports of Board of Direction, Secretary and Treasurer**

10:15 **Presentation of Awards**

The Norman Medal to GERARD H. MATTHES, Hon. M. ASCE.

The J. James R. Croes Medal to F. H. KELLOGG, M. ASCE.

The Thomas Fitch Rowland Prize to H. M. WESTERGAARD, M. ASCE.

The James Laurie Prize to G. H. HICKOX, M. ASCE, A. J. PETERKA, Assoc. M. ASCE and R. A. ELDER, Jun. ASCE.

The Arthur M. Wellington Prize to ARTHUR CASAGRANDE, M. ASCE.

The Collingwood Prize for Juniors to ALFRED MACHIS, Jun. ASCE.

The J. C. Stevens Award to DONALD E. BLOTCKY, Assoc. M. ASCE.

The Karl Emil Hilgard Prize to VITO A. VANONI, M. ASCE.

The Leon S. Moisseiff Award to ALEXANDER HRENNIKOFF, Assoc. M. ASCE.

The James W. Rickey Medal to FRED W. BLAISDELL, Assoc. M. ASCE.

The J. Waldo Smith Fellowship to the UNIVERSITY OF CALIFORNIA and JOSEPH C. KENT, Jun. ASCE.

The Daniel W. Mead Prize for Juniors to S. L. MCFARLAND, Jun. ASCE.

The Daniel W. Mead Prize for Students to WILLIAM HENRY BLAIR, member of the University of California Student Chapter.

11:00 **Conferring of Honorary Memberships**

CHARLES B. BREED, M. ASCE, Professor Emeritus, Civil Engineering, and Consulting Engineer, Massachusetts Institute of Technology, Cambridge, Mass.

WILLIAM P. CREAGER, M. ASCE, Consulting Engineer, Buffalo, N.Y.

WILFORD W. DEBERARD, M. ASCE, City Engineer, Chicago, Ill.

THEODORE VONKARMAN, M. ASCE, Chief Consultant, Aerojet Engineering Corp., Azusa, Calif.

WILBUR M. WILSON, M. ASCE, Research Professor, Structural Engineering (Emeritus), University of Illinois, Urbana, Ill.

11:30 **New Business**

Report of Tellers on Canvass of Ballot for Officers

Introduction of President-Elect and New Officers

12:00 **Adjournment for Membership Luncheon.**

Annual Membership Luncheon—Wednesday, January 18

12:30 P.M. — **CENTURY ROOM** — **HOTEL COMMODORE**

NELSON A. ROCKEFELLER, President, International Basic Economy Association, will address this luncheon gathering. His subject will be:

THE ROLE OF ENGINEERS IN WORLD AFFAIRS

The former Assistant Secretary of State will bring an expert's analysis of pressing needs in international relations of the United States.

Toastmaster for the occasion:

JOHN P. RILEY, M. ASCE, Chairman of the Annual Meeting Committee; Director of Development, City Housing Authority, New York.

All members, their ladies, guests and friends of ASCE are cordially invited to attend this luncheon and enjoy the opportunity of sharing Mr. Nelson Rockefeller's stimulating address.

Technical Division Sessions—Wednesday Afternoon

Power Division

2:00 P.M. PARLORS B AND C

Presiding: George R. Strandberg, M. ASCE, Member, Executive Committee, Power Division

2:00 **Joint Committee on Masonry Dams**

Statistical Analysis of World-Wide Dam Construction

R. A. SUTHERLAND, M. ASCE, Hydraulic Engineer, Ebasco Services, Inc., New York, N.Y.

2:30 **Discussion**

A. V. KARPOV, M. ASCE, Consulting Engineer, Pittsburgh, Pa.

3:00 **Design and Construction of Underground Hydroelectric Power Plants**

JOSEPH D. LEWIN, M. ASCE, Consulting Engineer, New York, N. Y.

3:30 **Discussion**

GOSTA WESTERBERG, M. ASCE, Chief Director, State Power Board, Stockholm, Sweden.

CARLO SEMENZA, Vice-President and Chief Engineer, Societa Adriatica Di Elettricita, Venice, Italy.

L. BENDEL, Consulting Geologist, Lucerne, Switzerland.

Sanitary Engineering Division

2:00 P.M. WEST BALLROOM

Presiding: John H. O'Neill, M. ASCE, Chairman, Executive Committee, Sanitary Engineering Division

2:00 The Expanding Field of Sanitary Engineering

FRANKLIN THOMAS, President of ASCE, Dean of Students and Professor of Civil Engineering, California Institute of Technology, Pasadena, Calif.

2:45 Health Implications of Air Pollution

J. J. BLOOMFIELD, U.S. Public Health Service, Washington, D.C.

3:45 Panel Discussion—Water Resources and Control Measures Led by:

CARL G. PAULSEN, M. ASCE, Chief Hydraulic Engineer, Water Resources Branch, U.S. Geological Survey, Washington, D.C.

Structural Division

2:00 P.M. EAST BALLROOM

Presiding: Craig P. Hazelet, M. ASCE, Chairman, Executive Committee, Structural Division

2:00 Description of Flood Control Walls and Full Scale Tests

SAMUEL M. BAILEY, M. ASCE, Chief of Engineering Division, Corps of Engineers, Louisville, Ky.

2:30 Structural Design Factors of "T," "I" and Related Flood Walls

WILLIAM A. HEITMANN, Design Branch, Corps of Engineers, Louisville, Ky.

3:00 Design Factors of Special Walls and Miscellaneous Structures

SIDNEY F. FARMER, Assoc. M. ASCE, Structural Engineer, Corps of Engineers, Louisville, Ky.

Discussion

3:40 Earthquake Probabilities and Studies

ELLIOTT B. ROBERTS, M. ASCE, Captain, U.S. Coast and Geodetic Survey, Washington, D.C.

4:20 Analysis of Seismic Forces

GEORGE W. HOUSNER, Assoc. M. ASCE, Assistant Professor, California Institute of Technology, Pasadena, Calif.

Annual Meeting Dinner-Dance—Wednesday, January 18

GRAND BALLROOM, COMMODORE HOTEL

7:00 Assembly and cocktails, East Ballroom

7:45 Dinner Hour, Grand Ballroom

10:00 Dancing to the music of Harry Lefcourt and his orchestra

Special arrangements can be made for tables seating 10 persons. Members may underwrite complete tables. Orders for tables must be accompanied by a check in full and a list of guests.

The published seating list will close at 5:00 p.m., Tuesday, January 17. Tickets purchased after this hour will be assigned to tables in order of purchase. Sale of tickets will continue until 5:00 p.m., Wednesday, January 18. Ticket price is $8.00 per plate with special dance tickets for Juniors at $2.00 per couple.

Dress will be formal.

Student Chapter Conference

Wednesday Afternoon, January 18, Grand Ballroom, Hotel Commodore

2:30 p.m. **Meeting of Students, Faculty Advisers, Contact Members and Interested Members of ASCE**

The Metropolitan Conference of ASCE Student Chapters is sponsoring a meeting of students from Chapters throughout the New York Metropolitan area. The program will feature participation of both students and practicing engineers. Arrangements for the session are under the general direction of William Koff, Chairman of the Metropolitan Conference, and Robert Boesser, Chairman of Program Arrangements.

ASCE–AWWA Joint Luncheon

The American Water Works Association with cooperation of the ASCE Sanitary Engineering Division is holding a luncheon and panel discussion on Tuesday, January 17, in the Grand Ballroom of the Hotel Statler. The hour is 12:30. All members of ASCE are cordially invited to take part in this gathering. Subject of the session is "Influence of Federal Activities on Labor-Management Relations in Utilities."

Technical Division Sessions—Thursday Morning, January 19

Power Division

9:30 A.M. PARLORS B AND C

Presiding: Byron O. McCoy, M. ASCE, Member, Executive Committee, Power Division

9:30 Water Problems at Sunbury Steam Electric Station

CHARLES B. SEIB, M. ASCE, Hydraulic Engineer, Pennsylvania Power and Light Company, Allentown, Pa.

10:00 Discussion

H. K. FAIRBANKS, Ebasco Services, Inc., New York, N.Y.

10:30 Condensing Water Supply for Steam Electric Stations

A. W. REID, Hydraulic Engineer, Gilbert Associates, Reading, Pa.

11:00 Discussion

G. R. STRANDBERG, M. ASCE, Chief Hydraulic Engineer, Stone and Webster Engineering Co., Boston, Mass.

Conference of Faculty Advisers

Thursday, January 19, 9:30 A. M. South Room—Hotel Commodore

For all Student Chapter Faculty Advisers attending the Annual Meeting, a conference will be held to discuss matters of current importance. Under the chairmanship of Robert H. Dodds, Member, ASCE Committee on Student Chapters, this meeting will offer a time for exchange of information and development of new procedures.

Construction Division

9:30 A.M. GRAND BALLROOM

Presiding: Hal W. Hunt, M. ASCE, Program Chairman, Executive Committee, Construction Division

9:30 **Symposium on Proposals for Stretching the Construction Dollar of Public Agencies**

Contractor's Viewpoint

ROSS WHITE, M. ASCE, Vice-President, Brown & Root, Inc., Houston, Tex.

FRANCIS TOMPKINS, Assoc. M. ASCE, Chief Engineer, Chas. A. Tompkins Co., Washington, D.C.

Public Agency's Viewpoint

GRANT BLOODGOOD, M. ASCE, Chief Construction Engineer, U.S. Bureau of Reclamation, Denver, Colo.

W. E. REYNOLDS, M. ASCE, Commissioner of Public Buildings, Public Buildings Adm., Washington, D.C.

Structural Division

9:45 A.M. EAST BALLROOM

Presiding: Craig P. Hazelet, M. ASCE, Chairman, Executive Committee, Structural Division

9:45 **Pressures Produced in a Shallow Rectangular Bin by Granular Materials in Loose and Vibrated Conditions**

R. L. MOORE, Assoc. M. ASCE, Research Structural Engineer, and J. R. SHAW, The Aluminum Laboratories, Aluminum Co. of America, New Kensington, Pa.

10:20 **On Limit Design of Beams and Frames**

H. J. GREENBERG, Professor, Carnegie Institute of Technology, and W. PRAGER, Chairman of Graduate Division of Applied Mechanics, Brown University, Providence, R.I.

11:00 **Torsion of Built-Up Girders**

FU-KUEI CHANG, Jun. ASCE, Research Assistant, and BRUCE G. JOHNSTON, M. ASCE, Director, Fritz Engineering Laboratory, Lehigh Univ., Bethlehem, Pa.

11:30 **Performance of Channels Loaded as Beams**

GEORGE WINTER, M. ASCE, Professor and Head, Department of Structural Engineering; W. LANSING, Instructor; and R. B. MCCALLEY, Jun. ASCE, Graduate Student in Civil Engineering, Cornell University, Ithaca, N.Y.

Construction Luncheon

Thursday, January 19, 12:30 p.m., Grand Ballroom, Hotel Commodore

Annual event sponsored by Construction Division featuring:

Symposium on Creation of Permanent United Nations Headquarters

Participating speakers:

ERNEST E. HOWARD, ASCE President-Elect
BYRON PRICE, U.N. Planning Commission
WALLACE K. HARRISON, Architect
LOU CRANDALL, Constructor

Per plate $3.50

Sanitary Engineering Division

9:30 A.M. WEST BALLROOM

Presiding: John H. O'Neill, M. ASCE, Chairman, Executive Committee, Sanitary Engineering Division

9:30 **Acceptable Standards for Natural Waters Used for Bathing**

CHARLES R. COX, Assoc. M. ASCE, Chief, Water Supply Section, New York State Department of Health, Albany, N.Y.

10:15 **Cincinnati Sewage Disposal Plan**

H. H. KRANZ, M. ASCE, City Engineer, Cincinnati, Ohio.

11:00 **Radioactive Isotopes in Sanitary Engineering Research**

HAROLD A. THOMAS, JR., and RALPH S. ARCHIBALD, Jun. ASCE; Research Fellows, Harvard University, Cambridge, Mass.

Technical Division Sessions, Thursday Afternoon, January 19

Construction Division

1:30 P.M. GRAND BALLROOM

Continuation of Panel Discussion of Construction Luncheon

Presiding: Elmer K. Timby, M. ASCE, Chairman, Executive Committee, Construction Division

Symposium on Creation of United Nations Permanent Headquarters

1:30 **The Civil Engineer's Part in Attaining the Objectives of the United Nations**

ERNEST E. HOWARD, President Elect, ASCE; Consulting Engineer, Howard, Needles, Tammen & Bergendoff, Kansas City, Mo.

1:40 **General Features of the Project**

BYRON PRICE, Assistant to the Secretary General, Headquarters Planning Commission, United Nations, Lake Success, New York.

Architectural Features of the Headquarters

WALLACE K. HARRISON, Director of Planning, United Nations Headquarters, New York.

Construction Organization and Methods

LOU CRANDALL, President, Fuller, Turner, Walsh, Slattery, Inc., and George A. Fuller Co., New York.

3:30 **Conducted Tour of U.N. Headquarters**

U.N. Headquarters are under construction at 42nd Street and the East River, and can be reached by public bus or cab transportation on 42nd Street or a four-block walk east from the Commodore Hotel. Details of the project will be explained by guides supplied by Fuller, Turner, Slattery & Walsh, combined contractors for the project. All taking this tour should be prepared for construction job conditions.

Highway Division

2:00 P.M. EAST BALLROOM

Presiding: Harold G. Sours, Assoc. M. ASCE, Chairman, Executive Committee, Highway Division

2:00 **A City Negotiates a Contract Agreement for Railroad Consolidation Incident to an Expressway Plan**

KENNETH KING, Traffic Engineer, City of New Orleans, La.

2:45 **Progress Toward the Ultimate in Highway Transportation**

FRED GRUMM, M. ASCE, Deputy State Highway Engineer, California Division of Highways, Sacramento, Calif.

3:30 **Highway Capacity Research Development of Principles**

O. K. NORMANN, Bureau of Public Roads, Washington, D.C.

Application to Long-Range Highway Planning Program Studies

J. P. BUCKLEY, M. ASCE, Automotive Safety Foundation, Washington, D.C.

Sanitary Engineering Division

2:00 P.M. WEST BALLROOM

Presiding: John H. O'Neill, M. ASCE, Chairman, Executive Committee, Sanitary Engineering Division

2:00 **Report of Committee on Sewerage and Sewage Treatment**

LANGDON PEARSE, M. ASCE, Chairman of Committee; Sanitary Engineer The Sanitary District of Chicago.

2:45 **Report of Committee on Refuse Collection and Disposal**

HENRY W. TAYLOR, M. ASCE, Chairman of Committee; Consulting Engineer, New York, N.Y.

3:00 Report of Committee on Fundamental Considerations on Rates and Rate Structures for Water and Sewage Works

SAMUEL A. GREELEY, Director, ASCE, Chairman of Committee; Consulting Engineer, Chicago, Ill.

3:15 Discussion of Committee Reports

4:00 A Tale of Two Cities

Motion picture depicting serious stream pollution problem in Twin City area in sound and color. Presented by KERWIN L. MICK, Assoc. M. ASCE, Chief Engineer and Superintendent, Minneapolis–St. Paul Sanitary District, St. Paul, Minn.

Waterways Division

2:00 P.M. PARLORS B AND C

Presiding: Max C. Tyler, M. ASCE, Chairman, Executive Committee, Waterways Division

2:00 Film with sound, The Valley of the Giant

2:30 Geology of Alluvial Valley of Lower Mississippi and Its Control of River's Regimen

H. N. FISK, Consulting Geologist, Humble Oil and Refining Co., Houston, Tex.

3:15 Great Floods of the Lower Mississippi and Design Flood

E. J. WILLIAMS, JR., Assoc. M., ASCE, Senior Engineer, Mississippi River Commission, Vicksburg, Miss.

3:30 Stage Predictions for Flood Control Operations

R. E. KING, Engineer, Mississippi River Commission, Vicksburg, Miss.

4:00 Mississippi River Levees

CHARLES SENOUR, M. ASCE, Chief Engineer, Office of the President, Mississippi River Commission, Vicksburg, Miss.

R. A. LATIMER, Head Engineer, Mississippi River Commission, Vicksburg, Miss.

Men's Smoker and Show

THURSDAY, 8:00 P.M.—GRAND BALLROOM, HOTEL COMMODORE

The Smoker presents the best opportunity of the Annual Convention to see your friends. This is a strictly informal evening of fun with the best of entertainment from the Broadway shows, refreshments, smoker, a bar, and music throughout the evening for aspiring choral groups.

8–9 p.m.—Warm-up period, with the kegs a-pouring.

9–10 p.m.—An hour of entertainment long to be remembered.

10 p.m. till you name the hour—Sandwiches, snacks, beer and coffee with bar service.

Don't miss the Show!

Featuring:

JONNY WOODS—Original Radio Satirist

JOAN BARRY—Astonishing control dancer (from Diamond Horseshoe)

MAGIC BY DE'LAGE and SHIRLEY (from Capitol Theater)

MILO and MORAN—The Home Run Hitters of Harmony

KEN WHITMER and Company—The King of Instrumentalists

Music and laughter from KIRK & FAY. Ballads by some of the outstanding ASCE singers as the evening progresses. Bring your own best stories.

NOTE: The show feature of the Smoker has been timed so that all attending college reunion dinners and other dinners will have ample time to arrive in time for all acts. Refreshments after the show.

Technical Division Sessions, Friday Morning, January 20

Hydraulics Division

9:30 A.M. WEST BALLROOM

Presiding: Albert S. Fry, M. ASCE, Chairman, Executive Committee, Hydraulics Division

9:30 Wave Theories in Hydraulic Engineering

MARTIN A. MASON, Assoc. M., ASCE, Chief, Engineering and Research Branch, Beach Erosion Board, Washington, D.C.

10:15 Characteristics of the Solitary Wave

JAMES W. DAILY, Assoc. M. ASCE, Assistant Professor of Hydraulics; and SAMUEL C. STEPHAN, JR., Jun. ASCE; Research Assistant, Massachusetts Institute of Technology, Cambridge, Mass.

11:00 Engineering Aspects of Long Period Waves and Surges in Harbors

JOHN CARR, California Institute of Technology, Pasadena, Calif.

Soil Mechanics and Foundations Division

9:30 A.M. GRAND BALLROOM

Presiding: James H. Stratton, M. ASCE, Chairman, Executive Committee, Soil Mechanics and Foundations Division

9:30 Compaction Symposium

(1) A Simplified Laboratory Compaction Test for Fine-Grained Soils

STANLEY D. WILSON, Assoc. M., ASCE, Assistant Professor of Soil Mechanics, Harvard University, Cambridge, Mass.

(2) Field Compaction and Triaxial Compression Tests

WILLIAM J. TURNBULL, M. ASCE, Chief, Soils Division, Waterways Experiment Station, Vicksburg, Miss.

(3) Effective Stresses and Pore-Water Pressures in Soils during Compaction

JOHN L. MCRAE, Research Associate, Northwestern University, Evanston, Ill.

Surveying and Mapping and City Planning Divisions—Joint Session

9:30 A.M. EAST BALLROOM

Presiding: George D. Whitmore, M. ASCE, Chairman, Executive Committee, Surveying and Mapping Division; Lawrence V. Sheridan, M. ASCE, Chairman, Executive Committee, City Planning Division

9:30 Survey and Map Requirements for Modern City Planning

CHARLES A. BLESSING, Assoc. M. ASCE, Director, Planning Division, Chicago Plan Commission, Chicago, Ill.

10:00 **The Mapping Program of Cincinnati and Hamilton County**

HENRY H. KRANZ, M. ASCE, City Engineer, Cincinnati, Ohio.

10:30 **Discussion**

HAROLD M. LEWIS, M. ASCE, Consulting Engineer, New York, N.Y.

HARRY W. ALEXANDER, M. ASCE, Harland Bartholomew and Associates, Newark, N.J.

L. T. ILIEL, Vice-President, Fairchild Aerial Surveys, Los Angeles, Calif.

FORD BARTLETT, M. ASCE, President, Lockwood, Kessler and Bartlett, Inc., Engineers, Brooklyn, N.Y.

Waterways Division

9:30 A.M. PARLORS B AND C

Presiding: Max C. Tyler, M. ASCE, Chairman, Executive Committee, Waterways Division

9:30 **Diversions**

C. P. LINDNER, M. ASCE, Chief Engineer, Office Division Engineer, South Atlantic Division, Atlanta, Ga.

10:00 **Morganza Floodway Control Structure**

Brig. Gen. P. A. FERINGA, M. ASCE, President, Mississippi River Commission, Vicksburg, Miss.

10:45 **Bank Stabilization by Revetments and Dikes**

R. H. HAAS and H. E. WELLER, Senior Engineers, Mississippi River Commission, Vicksburg, Miss.

Cooperative Session

of

U.S. Council of the International Association for Bridge and Structural Engineering

Friday, January 20—10:00 a.m.
Hotel Commodore, South Room

Technical Division Sessions, Friday Afternoon, January 20

City Planning Division

2:00 P.M. EAST BALLROOM

Presiding: Lawrence V. Sheridan, M. ASCE, Chairman, Executive Committee, City Planning Division

2:00 **Application of Social and Economic Facts in City Planning**

HOWARD WHIPPLE GREEN, M. ASCE, Director, Real Property Inventory of Metropolitan Cleveland, Cleveland, Ohio.

2:45 **Realistic Accomplishments of Highway Planning Objectives in the Chicago Region**

HUGO J. STARK, M. ASCE, Assistant Chief Engineer, Cook County Highway Department, Chicago, Ill.

3:30 **Practical Aspects of Transportation Planning in Large Metropolitan Areas**

LESLIE WILLIAMS, Assoc. M. ASCE, Secretary, Executive Committee, City Planning Division; Consultant, Traffic and Transportation Planning, New York, N.Y.

4:00 **Discussion**

RICHARD E. DOUGHERTY, Past-President, ASCE; Consultant, New York Central Railroad, New York, N.Y.

GILMORE D. CLARKE, M. ASCE, Consultant, Clarke, Rapuano and Holleran, New York, N.Y.

FRANK H. MALLEY, M. ASCE, Director of Planning, Providence, R.I.

Hydraulics Division

2:00 P.M. WEST BALLROOM

Presiding: Albert S. Fry, M. ASCE, Chairman, Executive Committee, Hydraulics Division

2:00 **Engineering Aspects of Wave Mechanics**

J. W. JOHNSON, M. ASCE, Associate Professor of Mechanical Engineering, University of California, Berkeley, Calif.

3:00 **Wave Forces on Breakwaters**

ROBERT Y. HUDSON, Assoc. M. ASCE, Hydraulic Engineer, U.S. Waterways Experiment Station, Vicksburg, Miss.

Soil Mechanics and Foundations Division

2:00 P.M. GRAND BALLROOM

Presiding: James H. Stratton, M. ASCE, Chairman, Executive Committee, Soil Mechanics and Foundations Division

2:00 **Analysis of Groundwater Lowering Adjacent to Open Water**

STUART B. AVERY, JR., Consulting Engineer and Lecturer on Foundations, Harvard University, Cambridge, Mass.

2:45 **Measurement of Stress in Rock by Strain Relief Method**

DOUGLAS MCHENRY, M. ASCE, Head, Structural Research Section, Bureau of Reclamation, Denver, Colorado.

3:30 **Strength of Clays in Actual Slides**

LOUIS BERGER, Assoc. M. ASCE, Associate Professor of Civil Engineering, Pennsylvania State College, State College, Pa.

Waterways Division

2:00 P.M. PARLORS B AND C

Presiding: Max C. Tyler, M. ASCE, Chairman, Executive Committee, Waterways Division

2:00 **Improvement of Lower Mississippi River for Navigation and Aids to Navigation**

AUSTIN B. SMITH, M. ASCE, Principal Engineer, Mississippi River Commission, Vicksburg, Miss.

2:30 **Harbor at Memphis, Tenn.**

WILLIAM B. FOWLER, M. ASCE, City Engineer, Memphis, Tenn

3:15 **The Port of Baton Rouge, La.**

LEO M. ODOM, M. ASCE, Consulting Engineer, Baton Rouge, La.

4:00 **Some Engineering Aspects of the Algiers Lock and Canal at New Orleans, La.**

Col. GEORGE H. HUDSON, M. ASCE, Chief, Engineering Division, New Orleans District, Corps of Engineers, New Orleans, La.

Surveying and Mapping Division

2:00 P.M. SOUTH ROOM

Open Executive Committee Session

Presiding: George D. Whitmore, M. ASCE, Chairman, Executive Committee, Surveying and Mapping Division

NYSSWA Sessions

New York State Sewage Works Association meeting, Friday and Saturday a.m., January 20-21, Hotel Statler. (Members of ASCE are cordially invited to attend all functions of this meeting.)

College Reunions Scheduled

Chi Epsilon Honorary Civil Engineering Fraternity Luncheon

Members of Chi Epsilon, their families and guests—men and women—will have their 16th Annual Luncheon at 12:30 p.m., January 19, 1950, at Rockaway Restaurant, 159 East 42d Street. Expense $2.00 or less per person. For further information and reservations, contact Harold T. Larsen, Room 1610, Engineering Societies Building (Pennsylvania 6-9220, Ext. 82).

University of Illinois Civil Engineering Alumni Dinner

The University of Illinois Civil Engineering Alumni and their friends will meet for their 21st annual informal dinner on Thurs-

day evening, January 19, 1950, 6:00 p.m., at Sacher Restaurant, 303 Madison Avenue (private dining room, South of 42d Street); $2.30 per plate complete. The dinner is timed, as usual, so that there will be ample time to reach the Society's Smoker. For further information and reservations, contact Harold T. Larsen, Room 1610, Engineering Societies Building (telephone Pennsylvania 6-9220, Ext. 82), or Maurice N. Quade, Parsons, Brinckerhoff, Hall and Macdonald, 51 Broadway, (Phone Whitehall 3-7980).

Massachusetts Institute of Technology Dinner Meeting

A dinner meeting of the MIT Club of New York will be held on Thursday evening, January 19, at the Hotel Commodore. Note that the time of this affair for civil engineering graduates who are members of ASCE has been changed so that a dinner meeting can be held preceding the ASCE Smoker.

Informal discussion of the latest activities of the Civil Engineering and Sanitary Engineering Department at MIT will be led by Prof. John B. Wilbur, head of this department. Activities of graduates will be related.

The time is 6:30 p.m., on Thursday, January 19, and the location the South Room of the Hotel Commodore. For further information, contact the luncheon chairman, William H. Correale, Plaza 7-8001.

Rutgers University Alumni Dinner

Rutgers University Civil Engineering Alumni will meet for their annual dinner at 6:30 p.m. on Thursday, January 19. This will be an opportunity to see your college mates and later attend the ASCE Men's Smoker.

Columbia University Alumni Dinner

The Columbia University Department of Civil Engineering cordially invites all alumni to the twenty-ninth annual informal alumni dinner on Monday, January 23rd at the Men's Faculty Club, 117th Street and Morningside Drive. The group will gather at 6:00 p.m. in the lounge and dinner will be served at 7:00 p.m.

To Entertain the Ladies

Under the guidance of the Ladies' Committee on Entertainment, with Mrs. John Riley, Chairman, an interesting group of events has been scheduled.

Luncheons and Dinner-Dance

The ladies are invited to attend the Wednesday and Thursday luncheons and the Dinner-Dance, as noted elsewhere.

Thursday Fashion Show and Tea

Arrangements have been made for a Fashion Show in the Century Room of the Hotel Commodore on Thursday afternoon, January 19th, at 4:00 p.m. Tea will be served by members of the Ladies' Committee. Tickets are $2.50.

Adele Simpson, skyrocketing success in the New York fashion world, will offer a premier showing of spring clothes. The fashion press— *Vogue*, *Harper's Bazaar*— and such popular magazines as *Life*, constantly report her latest tricks for achieving smartness through beauty.

Thursday Evening Sociable

On Thursday evening, in Parlor A, Clara Edwards (the wife of Dean Edwards, Member and former Director of the Society) will speak to the ladies on "The Lure of Collecting." Mrs. Edwards is an authority on antiques and an exhibitor at many national shows. She will be remembered as the winner of the DuBarry Success School course at last year's tea and will report on the course for, as she says, "It is fun to be made over."

Friday Morning Tour to Ladies Home Journal

The ladies are invited to tour the Editorial Workshop of *The Ladies' Home Journal*, Friday morning, January 20th, from 10 to 12 o'clock. They will visit the offices of the editors, the experimental laundry and kitchens, and the entertainment and dining rooms, and enjoy the magnificent view of the city from the office windows. Those who saw the *Ladies' Home Journal* article in May, entitled "How the Journal Lives," had a photographic preview of the visit. The Workshop is in the RKO Building, Radio City. No charge. Reservations, limited to TWENTY total, at Ladies' Headquarters.

Friday Trip to Lake Success

The ladies are invited to the excursion on Friday afternoon to the United Nations Headquarters at Lake Success. As noted elsewhere, tickets are $2.00, exclusive of lunch, and may be obtained in advance or at Registration Desk. The trip starts at 12 noon from the Commodore Hotel.

Ladies' Headquarters

The Ladies' Headquarters, Rooms 119-121, will be available day and evening for rest, cards or for meeting friends. Registration of all ladies attending the meeting is requested. Tickets and information will be available for broadcasts, the Empire State Building, and other points of interest. A Friday evening trip through the NBC Studio has been arranged. Reservations can be made at the Ladies' Headquarters. For those interested in shopping, there will be available a selected list of dealers who have offered to extend preferential treatment to our members or their wives. It is expected that these firms will include dealers in electrical appliances, furniture, jewelry and luggage, as well as sporting goods and toys.

Convention Excursions

Construction Excursion

THURSDAY, JANUARY 19, 3:30 P.M.

SPONSORED BY CONSTRUCTION DIVISION

Tour of Permanent United Nations Headquarters under construction at 42nd Street and East River site. Conducted by Fuller, Turner, Slattery & Walsh, combined contractors for this remarkable project. Public bus or cab transportation from opposite 42nd Street entrance of Commodore Hotel or a four-block walk east from the hotel. All on tour should be prepared for usual construction job conditions.

Motor Trip to Lake Success

Motor coach trip to United Nations in action. Luncheon will be available at reasonable cost in the U.N. Staff Cafeteria. There will be a speaker and visit to a U.N. Committee in session. Friday, January 20th at 12 Noon. Transportation Fee, $2.00 per person.

Radio Tour

Conducted tour of NBC's Broadcasting and Television Studios in Radio City at special rate of 50 cents. Meet at Registration Desk. Friday, January 20, 1950, 7:30 p.m.

See Grand Central

Behind the Scenes at Grand Central Terminal. New York Central engineers will conduct small groups through the "innards" of this vast station and explain its workings. Meet at the Registration Desk. Saturday, January 21, 1950, 9:45 a.m. No fee, but please secure tickets at the registration desk.

See New York from the Top

Visit to Empire State Building Observatories. Special discount rate tickets will be available at the Registration Desk for the use of members and guests. Special rate of 95 cents, including tax, is offered instead of the usual $1.20 rate.

Excursion to "United Nations in Action"

FRIDAY AFTERNOON, JANUARY 20, AT 12:00 NOON

A visit to the United Nations is a popular and profitable New York City pilgrimage. Many visitors return so impressed that they repeat the trip time and again.

The committee has selected this as the most appealing excursion trip in the city and has made the necessary arrangements for our group.

Private motor coaches will leave the Commodore Hotel at 12:00 noon and will pro-

ceed directly to the United Nations temporary headquarters, where we have been accorded the privileges of the Staff Cafeteria. The cafeteria serves good food at reasonable cost and you may buy as little or as much as you like. Many visitors particularly enjoy this opportunity to rub elbows with the various national staff members.

After luncheon we will be addressed by a U.N. speaker and will visit the U.N. Committee in session that afternoon. You will be interested in seeing and hearing the U.N. members taking part in the discussion and in hearing the on-the-spot translations made simultaneously in five languages with as little as one second time lag. Translations are heard over individual earphones available for visitors' use.

Motor coaches will arrive back at the Commodore at 5 p.m. for the convenience of members planning to take an evening train or planning to make the Radio City tour in the evening.

Transportation fee is $2.00 a person. Please order tickets in advance. Capacity limited. Buses load in front of the Commodore, 42nd Street at 12:00 noon.

Tour of NBC Studios

For those interested in an escorted tour of National Broadcasting Company's broadcast and television studios, the Committee has made arrangements for discount tickets (price 50 cents each) which will be available for those desiring to take the trip with an ASCE party forming at the hotel Registration Desk at 7:30 p.m., January 20. These tickets will also be available for individual members or guests interested in making the trip at some other time during the Annual Meeting.

NBC has promised to advise us in December regarding the broadcasting programs for Friday evening, January 20. It is expected that sufficient tickets will be available for members or their guests for these performances.

Post-Convention Bermuda Trip

Leave New York Saturday, January 21

On the Saturday immediately following the ASCE Annual Meeting, a specially planned trip to Bermuda is offered for those who want to get away from winter.

The luxury-liner *Queen of Bermuda* has been selected for the cruise. For ASCE trippers excellent accommodations have been reserved in all price brackets. Bermuda's Hotel Princess will be the island headquarters.

The Itinerary

JAN.

21 Saturday, 3:00 p.m. Sail from New York, observing the famous bays and skyline. Tea served. Dancing in the evening.

22 **At sea.** The Gulf Stream, day-dream in your deck chair. Movies, tea, dancing.

23 **Bermuda.** The beautiful islands come into view. Cruise along the charming North Shore and into Hamilton Harbor, one of the loveliest in the world. Arrive Hamilton at 9 a.m.

24 **Bermuda.** About two and a half days in Bermuda. Opportunity for unusual sightseeing drives, visits to the caves and coral gardens, shopping, golf, or other diversions.

25 **Bermuda.** Plenty of time today for last-minute purchases or drives. Leave Hamilton at 3:00 p.m.

26 **Again at sea** in the Gulf Stream, dreaming of a return to Bermuda. Movies, tea, dancing.

27 **Arrive New York,** 9:00 a.m.

The Queen Is Pleasure Planned

The cruise ship *Queen of Bermuda* was especially designed on a world-cruise pattern for the Bermuda run. Every room has a private bath as well as forced ventilation directly under the control of the passengers in each room. The spacious lounges and cafes, swimming pool, ball room, and cozy nooks give the *Queen* the atmosphere of an exclusive club. Among its many other unusual features is a "top" dance band.

Stay at the Hotel Princess

The Hotel Princess is one of the most distinguished addresses in the famous coral islands. It stands in its own private peninsula overlooking Hamilton Harbor and the landscaped hills beyond. Every room has an exquisite view. The dining room is a glass-enclosed deck facing the water. Its salons and lounges are delightful. It is outside the city and yet only a ten-minute, interesting walk to the shops.

Speaking of Price

Prices for the tour are all-inclusive, ranging from a minimum of $180.30, and depend on accommodations selected on the cruise ship. Detailed information should be requested from, and all arrangements made with your local travel agent or the New York agency representative who has handled similar trips for ASCE:

LEON V. ARNOLD
36 Washington Square, West
New York 11, N.Y.

Arrangements must be made before December 15, to assure desired accommodations.

Behind the Scenes at Grand Central Terminal

SATURDAY MORNING, JANUARY 21, 9:45 A.M.

Few of the 60,000,000 passengers who use the Grand Central Terminal each year have any more than a vague idea of the complexity of its operations. The 67 terminal tracks service the 550 trains that enter and leave over the four busy Park Avenue approach tracks daily.

The New York Central Terminal Corp. has graciously agreed to conduct our members on a special tour which will include intimate inspection and explanation of the elaborate baggage handling system which places passengers' luggage on the right train in a very few minutes; platform and track construction, including a tour of one of the little-known loop tracks; insulated footings and columns for the huge buildings built above the trackage, and utility services for these buildings; the efficient mail handling facilities; drainage features; and an intimate inspection of the lower-level control tower.

NO FEE. PLEASE SIGNIFY your intention of attending in order that arrangements can be made for the correct number of guides. Meet at Registration Desk before 9:45 a.m.

Hotel Accommodations

Headquarters for the Annual Meeting will be the Hotel Commodore adjacent to Grand Central Terminal in New York City. Special arrangements have been made to accommodate meeting visitors at the Headquarters Hotel.

A special reservation form to assure accommodations is provided for your use. See page 92. Send this form in early. Late reservations may have to be assigned to other nearby hotels.

Information and Registration

An information and registration desk will be maintained in the Ballroom Foyer at the Headquarters Hotel from 9 a.m., Wednesday, January 18, to Friday noon, January 20. Mail and messages will be held for members at the Information Desk

Meeting Committees

John P. Riley, *Chairman*
Wm. S. LaLonde, Jr., *Vice-Chairman*
Edward J. Cleary, *Past-Chairman*
William McK. Griffin, *Board Contact Member*

Wednesday Membership Luncheon

J. M. Garrelts, *Chairman*
John M. Buckley — Edward Wininger

Dinner-Dance

Raymond L. Brandes, *Chairman*
Walter S. Douglas, Jr. — J. M. Garrelts

Ladies' Entertainment

Horace A. Vanderbeek, *Chairman*
Raymond L. Brandes — John R. Zehner

Ladies' Committee

Mrs. John Riley, *Chairman*
Mrs. Wm. S. LaLonde, Jr., *Vice-Chairman*
Mrs. Edward J. Cleary, *Past-Chairman*

Mrs. Ford Bartlett	Mrs. Eugene M. Itjen
Mrs. Waldo Bowman	Mrs. C. B. Molineaux
Mrs. Raymond L. Brandes	Mrs. Arthur E. Poole
Mrs. John M. Buckley	Mrs. Carlton Proctor
Mrs. Wm. N. Carey	Mrs. Kirby Smith
Mrs. Walter S. Douglas, Jr.	Mrs. William J. Shea
Mrs. J. M. Garrelts	Mrs. Samuel D. Stickle
Mrs. Morris Goodkind	Mrs. Charles E. Trout
Mrs. Wm. McK. Griffin	Mrs. Edward Wininger
Mrs. Alfred Hedefine	Mrs. John R. Zehner

Men's Smoker

Charles B. Molineaux, *Chairman*
Ford Bartlett — Harold E. Levenson
Samuel D. Stickle

Excursions

Eugene M. Itjen, *Chairman*
Horace A. Vanderbeek — Harold E. Levenson
John R. Zehner

Thursday Construction Luncheon

J. M. Garrelts, *Annual Meeting Committee Representative*
Arthur E. Poole, *Construction Division Representative*

Los Angeles Builds Three Hydro Plants in Owens River Gorge

W. C. MASON

Project Engineer, Owens Gorge Project, Department of Water and Power, City of Los Angeles

PROGRESS ON TUNNEL headings for the Owens River Gorge Power Project set new world's records in October, when the Owens Tunnel Contractors advanced through jointed pink rhyolite 102 ft in 24 hours and 2,204 ft in 31 consecutive working days. Eleven miles of pressure tunnels in three sections form part of the new $42,000,000, 112,500-kw development on the Los Angeles–Owens River Aqueduct by the City of Los Angeles. Three identical powerhouses, each containing one 37,500-kva generator and one 51,200-hp Francis-type turbine, operating under a static head of about 790 ft, are interconnected for remote control, permitting operation as though the turbines were under the same roof. The three plants when completed will be capable of delivering 600,000,000 kwhr per year over a 258-mile, 230-kv single-circuit transmission line to Los Angeles.

CONSTRUCTION IS now being pushed on the three power tunnels for the Owens River Gorge hydroelectric project of the City of Los Angeles. To understand the relation of these tunnels to the rest of the project it is necessary to know the outstanding features of the Los Angeles–Owens River Aqueduct and its power developments.

The history of the Los Angeles Aqueduct started in 1905, when the population of Los Angeles had reached about 200,000 and water supply sources were rapidly being exhausted. That year and in 1907, $24,000,000 in bonds was authorized to finance the purchase of Owens Valley lands and water rights, and the construction of the 240-mile-long Los Angeles Aqueduct. This aqueduct was designed to divert the 446 cfs (288 mgd) of water from the Owens River and most of its tributaries on the east slope of the High Sierras, and by gravity flow, through open channels, tunnels, siphons and closed conduits, deliver it to reservoirs within, or adjacent to, the city limits.

To insure an adequate supply of water for its ever increasing population, Los Angeles next went to the Mono Lake source 340 miles north of the city and actually north of San Francisco. In 1940 the Mono Craters tunnel and Long Valley Dam, known as the Mono Basin Development, were completed. They added 140 cfs (90 mgd) to the city's supply, an amount included in the 480 cfs momentary, and 446 mean annual capacity, of the Los Angeles Aqueduct system.

Power Development Follows

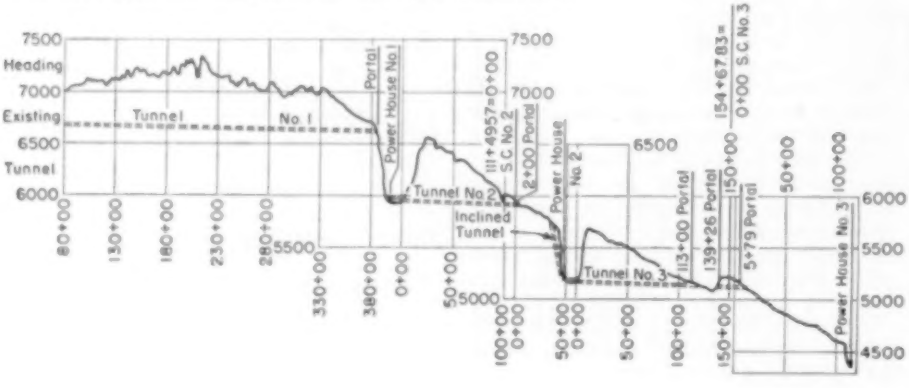
Incidental to the development of the Los Angeles Aqueduct for water supply was the development of hydroelectric power. Ten hydro plants have been built along the course of the aqueduct and on streams tributary to the Owens River. These ten plants, producing 118,300 kw, comprised the total capacity of Department-owned plants up to 1936.

In spite of later additions of power to the city system from Hoover Dam and from a five-unit steam plant at tidewater, bringing the total to a million kilowatts, the power need was still acute. Therefore in 1947 the Board of Water and Power Commissioners authorized the Owens River Gorge Power Project to develop an additional 112,500 kw.

The portion of the gorge now being developed is 300 miles north of downtown Los Angeles and 15 miles northwest of Bishop, Calif. (See Fig. 1.) The Owens River Gorge is a narrow V-notch in a great volcanic tableland, varying from 200 to 700 ft in depth, which contained a perpetually flowing stream. This area lies east of the steep eastern slope of the Sierra Nevada.

Core drillings along the tunnel line indicate that the entire region is highly fractured with seams, fissures and crevices lying in slip planes at various angles to the tunnel lines. In nearly all core holes drilled, water was lost at various depths, and it was difficult to obtain cores. After considerable preliminary study of topography, tunnel lengths, penstocks, surge-chamber requirements, available power plant sites, standardization of plant equipment and other pertinent factors for the total utilization of available head, it was determined that the most economical scheme from the standpoint of construction, operation and maintenance, was the building of three plants, all of practically equal heads of 750 ft, us-

FIG. 1. ELEVEN-MILE-LENGTH of 10-ft-diameter tunnel is being driven along rim of Owens River Gorge to divide 2,375 ft of static head from Lake Crowley to Birchim Canyon into three approximately equal net effective heads of 750 ft.



ing identical and interchangeable equipment.

Water regulation for this development is furnished by Long Valley Dam, which was constructed in 1940 at the northern end of the gorge, and controls runoff from the upper Owens River watershed and Mono Basin. This dam, with a present crest elevation of 6781.5 ft, creates Lake Crowley, a reservoir with a capacity of 183,000 acre-ft. When the dam was designed, allowance was made for an increase in height of 20 ft, which would increase the capacity to 315,000 acre-ft.

Average lake level was determined for design purposes as El. 6,775. This will be the elevation of the reservoir when approximately one-half full by volume after the dam has been raised. At the southern extremity of the system, at the junction of the Owens River Gorge and Birchim Canyon, the lower of the three plants will be located, at a tailbay elevation of 4,400 ft. The static head used in design is 2,375 ft.

Selection of Power Plant Locations

The locations of the three plants (Fig. 1) were selected so that, at full load, the net effective head on each plant would be approximately 750 ft. At full load, the only plant that will operate at variable heads is the upper one, Plant No. 1. This plant will be fed from Lake Crowley, which has a considerable fluctuation in water level.

From a small tailbay at Plant No. 1, water will be discharged into the tunnel leading to Plant No. 2. A similar tailbay at Plant No. 2 will deliver the water to the tunnel and penstock for Plant No. 3. Provision has been made to bypass any or all of the plants by utilizing the present channel of the Owens River. Because of the small reservoir capacities at Plants Nos. 1 and 2 it will be necessary for all three plants to pass the same amount of water at all times, the amount being controlled by the city's water demand.

Load changes will be made by adjusting the wicket gates on the turbine in Plant No. 1. A Venturi meter in the No. 1 penstock will measure the water flowing through this plant. The indication from this meter will be balanced against the indication of a similar meter at Plant No. 2, and the result will automatically control the wicket gates on the turbine in Plant No. 2 until the two meter readings balance. The wicket gates on the turbine in Plant 3 will be controlled by a similar metering and control system. The meter controls will be corrected by water-level controls to maintain the proper water levels in the tailbays at Plants Nos. 1 and 2. By proper adjustment of the rates of response of the two controls, it is expected that hunting can be eliminated, and the water levels in the two tailbays held within fairly close limits.

After passing through Plant No. 3, the water will be returned to Owens River, just above Rock Creek, to continue on its way to Los Angeles.

The three plants will be tied together by a remote-control arrangement, which will operate as though the three machines were in the same plant. Normally all the plants will be operated from the control room in Plant No. 3.

Shortly after the power project was authorized in June 1947, work was started on the permanent roads which were to be used for construction, operation and maintenance. These roads assumed major importance because of the roughness of the terrain, climatic changes, wear and depreciation on equipment, the long distances involved, and the 325,000 tons of steel, aggregate, material, and equipment that had to be moved. All roads were kept to a maximum grade of 8 percent and held to tangent alignment wherever at all practicable. Most of the 14 miles of roads so constructed had a good rock base. For subgrade and surfacing, decomposed granite borrow, graded with native rhyolitic sand and gravel, was used. The finished roadway is 18 ft wide and varies in thickness from $2^1/_2$ to 4 in. The road-pug method of mixing was used and 0.7 gal of SC-3 oil per sq yd was applied for each inch of thickness.

Two camps were constructed, one to house 250 men at Power Plant No. 3 and one to house 450 on the mesa equidistant by road between Plants Nos. 1 and 2. A trailer camp containing 90 spaces has been completed at the mouth of Birchim Canyon near U.S. Highway 395.

In April 1949, tunnel construction on the 10-ft bore was started by force account, and in June a contract was awarded to a syndicate of four contractors: Bressi and Bevanda of North Hollywood, Guy F. Atkinson of San Francisco and Long Beach, Teichert and Son of Sacramento and David Gordon of Denver, who had banded together as Owens Tunnel Contractors with Vincent Bressi as managing partner. The award for the tunnels and surge chambers was made on the syndicate's bid of $8,947,520.

Water from Lake Crowley is bypassed around Long Valley Dam into the Owens River through an existing horseshoe-shaped tunnel 6,576 ft long. This section will be lined with a steel liner. A new tunnel (tunnel No. 1) of 10-ft. $1^1/_4$-in. circular section, will extend the present outlet tunnel 31,050 ft to the rim of the gorge above the site of Power Plant No. 1. The major portion of the tunnel will have reinforced concrete lining (Fig. 2) but through a granite ridge crossing the tunnel alignment no reinforcing is contemplated. This tunnel will have a fall downstream of 1.5 ft. per 1,000 ft. The contractors started driving at the north portal on August 29 and are advancing at the rate of 60 ft per day. The ground is a compacted volcanic ash which has required no support to date. The first round was shot at the south portal on September 14 and an average advance of 39 ft per day is being made through blocky, broken rhyolite which has

SITE OF THIRD and lowest power plant in Owens Gorge Project is near Birchim Construction Camp, between Owens River and Gorge on right, and Rock Creek and Birchim Canyon on left. Power plant will stand at foot of grading for penstock on slope, to right of tank. Sewage collection house under construction in center foreground will serve permanent operators' cottages, later to occupy camp site.

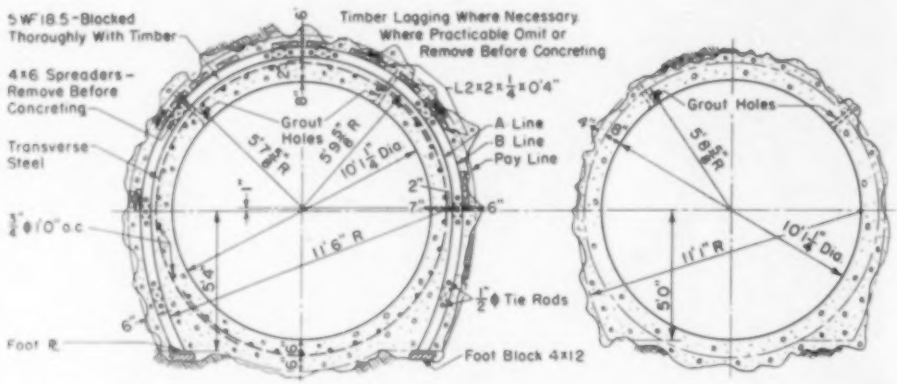


FIG. 2. ALL TUNNELS are pressure type, concrete lined. Considerable length through blocky rock requires timber lagging and steel supports, of which section at left, above, is typical. Other unsupported sections were lined with reinforced concrete. Section at right, above, is typical of unsupported sections requiring no reinforcing.

required approximately 50 percent support.

Tunnel No. 2, 11,092 ft long, starts at the afterbay of Plant No. 1. It is to be the same size and type of construction as Tunnel No. 1 but will have a slope of 2.3 ft per 1,000 ft to the point where it holes out of the ground on the mesa. The contractors, since June 11, have been driving this tunnel from the south portal at the rate of better than 40 ft per three-shift day. Approximately 65 percent of the tunnel to date has had to be supported by steel supports of the type shown in Fig. 2, because of the jointed and seamy condition of the rhyolite through which the bore is being driven. No heavy ground and no water has so far been encountered, and from core-hole drilling and geologic studies, none is expected.

Approximately 4,100 ft south of the south portal of Tunnel No. 2, an inclined tunnel near the rim of the gorge will be excavated to house the steel penstock. The canyon at Plant No. 2 is 500 ft deep and the walls are so precipitous and shattered that it was totally impractical to construct piers and anchors for a penstock on the surface. The 45-deg bore will vary from 9 ft to 10 ft in diameter. Approximately half the length will be through rhyolite and the remainder through a harder andesite. Work was started on an 80-ft adit on September 23, and the raise was started October 20.

The north section of tunnel No. 3 starts at the tailbay of Plant No. 2 and runs at a slope of 1.5 ft per 1,000 ft to a point where it reaches the surface of the mesa 11,805 ft south of Plant No. 2. There the tunnel connects with a steel siphon of $^1/_2$-in. plate, 10 ft in diameter and 2,639 ft long, which carries the water across a small valley to the south section of tunnel No. 3, which is a similar circular pressure tunnel 2,102 ft long.

Work was started by the contractors at the south portal of the north section of Tunnel No. 3 on July 18 and footage has been averaging close to 58 ft per day through blocky and jointed pink rhyolite similar to the type of ground in Tunnel No. 2.

At all the headings except the inclined tunnel, the contractor is averaging better than 8 ft per round, drilling a pattern of approximately 38 holes and loading with about 100 lb of 17 and 45-percent powder per round. (approximately 3 lb per cu yd of excavation).

World's records for rock bores of similar diameters have been broken on several occasions. In Tunnel No. 1 North, for a 24-hour period the contractor drove 89 ft on October 1; 86 ft on October 4; 90 ft on October 5; 94 ft on October 25; and 102 ft on October 27. From September 22 to October 27 inclusive (31 working days), an advance of 2,201 ft was made.

In Tunnel No. 3, the one-day world's record was broken on September 23 with an advance of 86 ft, on September 24 with 85 ft, 87 ft on September 28, and 82 ft on October 4. The world's record for 31 consecutive work days was broken by 344 ft in the period from August 25 to September 30 inclusive, when Tunnel No. 3 was driven a total of 2,204 ft, an average of 71 ft per day.

Neither water nor running ground has been encountered in any of the tunnels to date.

Steel Penstocks Bitumastic Enamel Lined

The penstocks are of electric-welded steel fabricated by the shielded-arc electric-fusion method in 30- and 40-ft lengths. The section of pipe which, when installed, will have a static head of less than 185 ft is of ASTM specification A283 Grade B steel plate, and the remainder is of ASTM specification A212 Grade B steel plate. The pipe is graduated from a diameter of 106 in. and a thickness of $^3/_8$ in. at the upper end to a diameter of 92 in. and a $1^1/_{16}$-in. thickness at the lower end. The inside is painted, by spinning, with one coat of hot bitumastic enamel $^3/_{32}$ in. thick over one primer coat. The outside surface consists of one coat of white enamel over one coat of red lead. Painting is being done in the fabricator's shop. After erection the pipe is to receive one coat of aluminum paint.

Supports for the penstocks are of two types, ring girder for the upper portions of the flat mesa sections, and single-saddle type for the steeper inclined portions. Supports are spaced about 60 ft apart on the mesa, and 30 ft on the steep slopes. Anchors and expansion joints are generally installed at 600-ft intervals. The metal in expansion joints is stainless clad steel. Permanent manholes for inspection and maintenance, and smaller pass-holes for introduction of welding leads, hoses and airlines, are fabricated into the pipe in the shop.

A Venturi tube is to be installed in each penstock, and will be completely shop fabricated and field welded into the penstock section. The Department has started excavation by force account but no construction work has been done on the pouring of the reinforced concrete piers and anchors, or on erection of the penstocks. Penstock No. 3 is being fabricated by the Southwest Welding and Manufacturing Co., and the contract for Penstock No. 1, Penstock No. 2 and the siphon in tunnel No. 3, was awarded to Consolidated Western Steel Corp.

Differential-type surge chambers of 30-ft and 40-ft diameters, with the inner chamber the same diameter as the tunnels, will be installed in each tunnel section just above the transition to the penstock. They are located at points where the ground level at the chambers is at static water elevation. This is done to require a minimum of excavation, and to avoid having water above the ground level, which would be subject to horizontal acceleration from the frequent seismic disturbances that occur in the area.

The capacity necessary for surges during load rejections will be obtained by extending the surge chambers an adequate distance above static-head level. Each surge chamber will have sufficient capacity to retain all water increase caused by full load rejection, and sufficient to operate the respective machines at full

load while the flows in the tunnels are being accelerated during load pickup.

The shaft for surge chamber No. 1 was excavated to a depth of 55 ft in September; surge chamber No. 3 was excavated to a depth of 40 ft in October; and work has started on the excavation of surge chamber No. 2 and will continue to the existing Tunnel No. 2 bore. The walls of the shafts are protected against disintegration by a Gunite coating of 6-in. minimum thickness.

Three Identical Power Plants

The three power plants are of approximately the same design, except that Plant No. 3 (Fig. 3) will have a considerably larger control room since this will be the control point for all three plants. The generators will not be enclosed in buildings but will be provided with covers for outdoor operation. The generator floor, at ground level, will act as a roof over the turbine room. Each plant will be equipped with an outdoor traveling crane with a 150-ton main hoist and a 25-ton auxiliary hoist for use during construction and for future overhauls. Contract for these cranes was awarded to Harnischfeger Corp.

Work was started in August 1949 on the excavation for the generator foundation at Plant No. 3. Ground level at this plant is about at El. 4,413, and the bottom of the reinforced concrete mat is to be at El. 4,370.87. As the river channel is about 25 ft above the bottom of the foundation, a sheetpile cofferdam for dewatering was required. Considerable difficulty was encountered in driving the sheetpiling, since the subsurface in this area is of sedimentary deposit with a conglomerate deposit of large boulders on an irregular understrata of rhyolite.

The turbines are of the vertical-shaft Francis reaction type with a rated horsepower of 51,200 when operating at 743-ft head and discharging 690 cfs. Speed will be 400 rpm. The turbines are being manufactured according to Department specifications by the Pelton Water Wheel Co. As the plants will operate at about the same head and in series, using the same rate of discharge, all parts will be identical and interchangeable. Since they will also operate automatically, all equipment has been designed for supervisory control.

Turbine runners are being cast in one piece of 18-8 stainless steel with replaceable monel-metal wearing rings and stainless-steel runner cones. Guide vanes also are 18-8 stainless steel with integral spindles. The turbine is so designed that the runner can be lowered through a removable section of the draft tube.

Upper sections of draft tubes are constructed in two pieces, each equipped with car wheels to permit removal sideways on a rail track. The top piece will act as a handling car for removing the runner and the lower piece is provided with two access doors for inspection. Both pieces are of cast steel with a stainless-steel liner immediately below the runner. The draft tube and elbow below the removable sections are being lined with steel plate.

With each turbine will be installed a mechanically controlled, hydraulically operated bypass valve which will function either synchronously or as a pressure regulator. The valve will receive its water from a separate branch of the main penstock. Operating synchronously, the valve can be adjusted so that the total water discharged by the turbine and the valve will be a predetermined amount. The distribution of water between the valve and the turbine depends on the electrical load on the generator. Operating as a pressure regulator, the rate of closing will be such as to prevent excessive pressure rises in the penstock.

With each bypass valve, energy absorbers are to be provided capable of absorbing and dissipating the 51,200 hp of energy from the water under maximum discharge condition. The valves will discharge through a separate steel-lined passageway.

Each turbine is equipped with two oil-pressure-operated, double-acting hydraulic cylinders, or servomotors, to operate the wicket gates or bypass valve. They will operate on a normal oil pressure of 200 psi, and will have a minimum operating time of 7 seconds for full opening or closing stroke but can be adjusted for a longer time interval.

Each of the three generators being built by the Westinghouse Electric Corp. will be 11,500-v, 3-phase, 60-cycle, 400-rpm, complete with direct-connected exciters, and have a continuous rating of 37,500 kva at unity power factor. They will be of the vertical-shaft outdoor type with two guide bearings.

Three Transformers at Each Plant

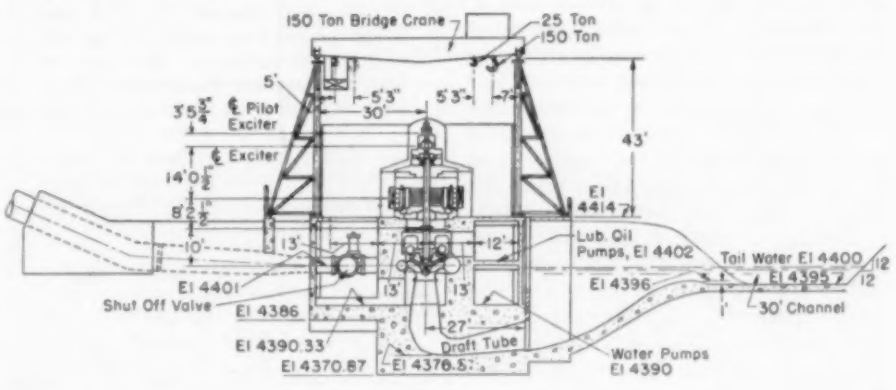
The step-up transformer bank at each plant will consist of three single-phase, 12,500-kva, 11,000-v delta to 230,000 wye, oil-immersed, forced air-cooled transformers. The transformers are self-cooled to 10,000 kva and are equipped with automatically controlled fans for cooling above that load. For the three plants, one spare transformer has been purchased.

At the Receiving Station in Los Angeles, the bank will consist of three single-phase auto-transformers, having a high-voltage rating of 220,000 v wye, a low-voltage rating of 132,000 v wye, and a tertiary winding having a voltage rating of 13,200 v delta and suitable for operating a synchronous condenser. The large power transformers for the power plants are being manufactured by Westinghouse Electric Corp. and those for the receiving station by the Allis-Chalmers Manufacturing Co.

The total of 112,500 kw and 600,000,000 kwhr per year to be made available from the plants will be transmitted to Los Angeles over a 230-kv single-circuit steel-tower transmission line approximately 258 miles along. The conductor for the line will be a 954,000-CM Aluminum Cable Steel Reinforced (ACSR) Transmission Line Conductor. The diameter of 1.196 in. is highly desirable in reducing corona losses, particularly at higher elevations, as at the northern end of the line where eleva-

(*Continued on page 95*)

FIG. 3. OUTDOOR-TYPE powerhouses—all three similar—are interconnected for remote control. Each contains one Francis-type turbine of 51,200-hp capacity operating at 400 rpm, and one generator of 37,500-kva capacity. Plant No. 3, for which cross section appears below, houses control room for all three plants.



Learning to Live with Atomic Radiation—a Challenge to Engineering Profession

From Paper Delivered Before Sanitary Engineering Division at Washington, D.C., Fall Meeting

ARTHUR E. GORMAN, M. ASCE

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IT WOULD BE hard to overemphasize the importance to sanitary engineers, now and in the future, of education and training in nuclear physics. The civil engineering profession in general, and sanitary engineers in particular, should be much more active in the new atomic energy industry both in obtaining a proper evaluation of their interests and in appraising their opportunities and obligations. Their activities are particularly needed in matters involving selection of sites for atomic energy plants, design and building of structures and facilities, and research and development dealing with water purification, waste disposal and environmental sanitation. Sanitary engineers and geologists in particular need special training in nuclear physics and operations of the atomic energy industry which deal with the disposal of radioactive and toxic wastes. Advice in their specialties is and will continue to be needed within and outside of this new industry.

Training of Engineers in Nuclear Physics

Meeting this need is a challenge the engineering profession should accept. Those charged with educating young engineers in the colleges and universities should arrange to include special courses in nuclear physics in the curricula—not that any considerable percentage of engineers will find employment in the atomic energy industry, but that as this and related industries grow, a knowledge of nuclear physics and an understanding of the properties of products used in or produced by atomic energy will become essential to all engineers.

A second aspect of the engineer training program deals with the need in the atomic energy industry for the advice and assistance of engineering experts who now have little or no knowledge of nuclear physics. Such experts need additional education and training if their services are to be used effectively. Such training presents an excellent opportunity for cooperation between the civil engineering profession and the Atomic Energy Commission.

Research in Disposal of Radioactive Wastes

Considerable progress has been made at various Atomic Energy Commission Areas of Operation in studying the properties of radioactive wastes from various process operations, but much more work needs to be carried out before the techniques and efficiencies measured in terms of activity removal and costs can be definitely determined. Much emphasis has been placed on the reclamation of products from wastes, and the reduction, by evaporation, of volume of wastes to be stored. Such treatments have made it possible to effect decontamination of effluent waters in certain areas pending development of treatment methods for disposal of final wastes. Chemical coagulation and sedimentation have been found effective in removing radioactivity, but where wastes contain dispersing agents, complications may arise and treatment must be carried out at high pH values. At Los Alamos it has been shown in bottle experiments that the zoogloeal bacteria developed in the activated sludge process are able to absorb about 95 percent of the plutonium in liquor contaminated by that long-lived radioactive element.

"We have to live with radiation. This has become a kind of Fourth 'R'. . . . The waste disposal problem is part of this general business of learning how to live with radiation. The way we learned to live with things before was to learn as much as we could about them.

"It is our earnest desire and our responsibility to seek to have this single phase of our responsibility well handled —as well as technical skill and energy and foresight at this stage can handle it."

—David E. Lilienthal, speaking at Waste Disposal Seminar sponsored by Atomic Energy Commission and held in Washington, D.C., last January.

A radioactive waste research laboratory which will permit a broadening of the scope of these studies from bottle experiments to pilot plant units using waste as discharged continuously from the operating or research areas concerned has been designed for construction at Los Alamos. The research on liquid waste disposal in this area is under the direction of a sanitary engineering staff with technical assistance and guidance by members of the staff of the University of California and the Environmental Health Center of the Public Health Service in Cincinnati. Meanwhile at the Oak Ridge National Laboratory, the Waste Disposal Section in the Health Physics Division is continuing research in disposal of low-activity wastes to the Clinch River. This work, which has much promise, is being done in cooperation with the Public Health Service and the Tennessee Valley Authority. At Johns Hopkins University research has shown that biological slimes such as are found in pipes, in drains carrying sewage, and in sewage treatment equipment have the power of adsorbing and concentrating many times the radioactivity in solutions with which they come in contact. Those who perform maintenance work on pipes, sewers, and other facilities contaminated by radioactive wastes will need, therefore, the protection of careful monitoring as they work on the facilities.

In May the Isotopes Division of the Atomic Energy Commission in Oak Ridge, Tenn., released its Circular B-6 entitled "Interim Recommendations for the Disposal of Radioactive Wastes by Off-Commission Users." This document is available to the public and has been supplied to state sanitary engineers.

In removal of radioactive particles from gaseous effluents at Atomic Energy Commission production and research areas much progress has been made. Filters of various types have been developed and installed which remove in excess of 99.5 percent of the radioactivity in such wastes. Scrubbers and electrostatic precipitators suitable for use in decontaminating gaseous effluents under the special

conditions which exist in the industry are being studied. Basic data are needed in regard to the size of particles in these gaseous effluents and the distribution and types of radioactive materials by sizes.

Recommended Permissible Limits of Radiation

Some time this fall recommendations for maximum permissible limits of radiation in air and water should be announced. Dr. K. Z. Morgan, Director, Health Physics Division, Oak Ridge National Laboratory, in his paper delivered at the Washington, D.C., Seminar on Waste Disposal, last January, suggested the following concentrations of general radioactive contaminants beyond the area of control:

Exposure In	Maximum Permissible Concentration in Microcuries per Cc	
	For Beta or Gamma Emitter	For Alpha Emitter
Water	10^{-7}	10^{-7}
Air	10^{-9}	5×10^{-12}

Two important developments have taken place in determining how water contaminated with radioactive material may be made safe. This is a matter of concern to all agencies responsible for supply of water whether civilian or military. About July 1, a research program under contract between the Atomic Energy Commission and the Sanitary Engineering Department, Massachusetts Institute of Technology, got under way. Standard procedures and facilities for water treatment will be studied as to their ability to remove certain radioactive isotopes from water. Another contract, this one in cooperation with the National Military Establishment, is about to be established at the Oak Ridge National Laboratory for similar research covering civilian and military water purification methods and equipment and using a wide variety of contaminants. These studies will continue over a period of two years, it is expected, and may be extended to other areas and research institutions, depending on the results obtained and the availability of experienced technicians.

AEC Cooperation With Other Agencies

The Ground Water Division of the U. S. Geological Survey has completed the first phase of a comprehensive study of the geology of the Hanford area in relation to waste disposal. At Los Alamos experts from that Division are giving technical direction to studies of the geology of the region in relation to the development of a new source of water supply and in connection with the disposal of waste effluents into the Pueblo and Los Alamos canyons.

At the Oak Ridge National Laboratory both the Geological Survey and the Department of Geology of the University of Tennessee are cooperating with the Atomic Energy Commission in studying the effect of disposal of wastes on surface areas in the X-10 Area. The Survey is conducting extensive research as to geology and water supply in the area of Arco, Idaho, where plans for a new reactor testing station are being developed. Studies of geology in the area of the Brookhaven National Laboratory on Long Island have been carried out by the Ground Water Division for over a year. These studies add substantially to the knowledge of groundwater conditions in that area and have provided the Atomic Energy Commission staff with important information in connection with the disposal of wastes from that laboratory.

Columbia River Study Proposed

During the coming year funds may be made available to permit the Public Health Service to cooperate in a comprehensive study of the Columbia River in the vicinity of the Hanford Works. Such a study is considered advisable because the expected impoundment of this river will extend as far back as Richland Village when the McNary Dam, now under construction, is completed. The river receives low-level radioactive cooling water from the Hanford reactors. Information is desired concerning the quality of the water before and after this impoundment in order to ascertain its effect, particularly with respect to the concentration of radioactivity by biological life in the river.

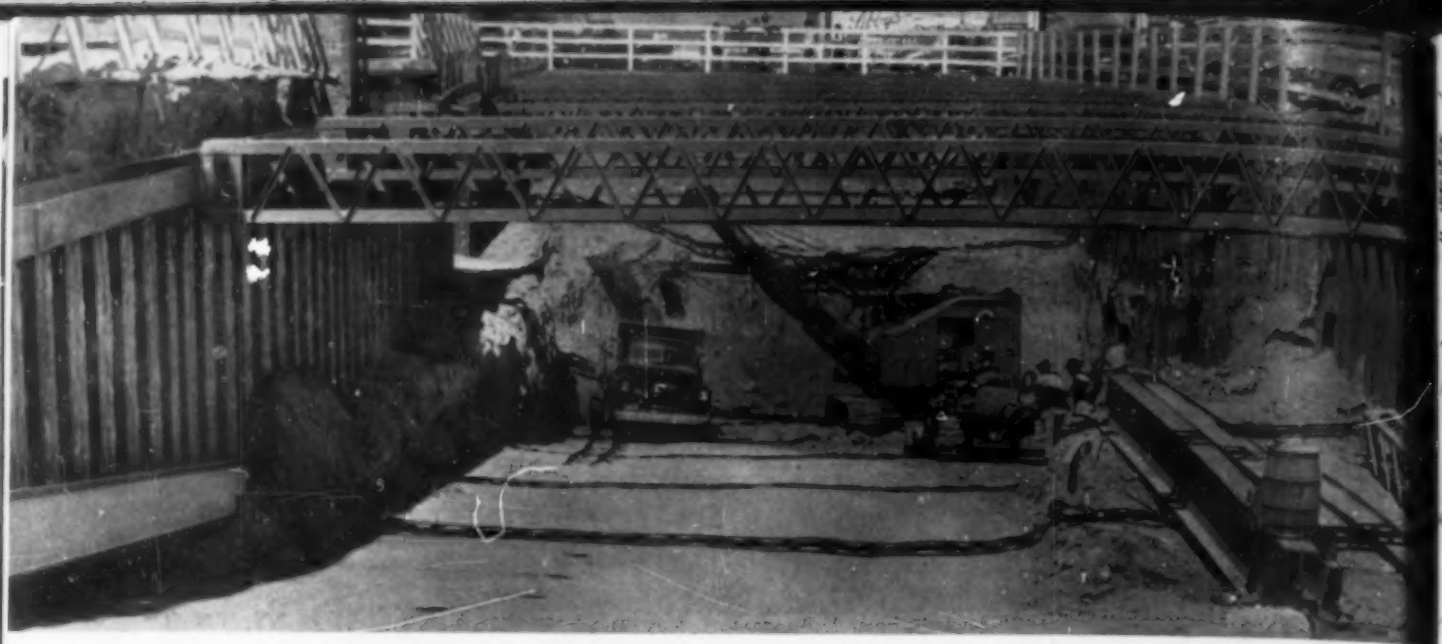
The U.S. Weather Bureau has continued to cooperate with the Commission in studies of meteorology in the vicinity of production and research areas. Special studies have been in progress at the Brookhaven and Oak Ridge National Laboratories for many months. A contract for investigating the meteorology in the vicinity of the reactor testing station area near Arco, Idaho, has recently been made and negotiations are in progress for assistance at Los Alamos. The University of Washington has recently been given a contract for special meteorological research of interest to the Hanford Office of Operations.

The Bureau of Mines has been requested to cooperate in the development of an incinerator for the destruction of radioactive material and for the decontamination of products of combustion.

These excellent cooperative relations between other government agencies and the Atomic Energy Commission are most important. They not only serve to obtain answers to problems of immediate interest and concern to the Commission, but they help to introduce to these long-established federal agencies some of the technical aspects of the atomic energy industry with which they may be increasingly concerned as the use of nuclear energy is extended in this country.

First All-Aluminum Arch Bridge Nears Completion

ERECTION of the all-aluminum highway bridge at Arvida, Quebec, is now approaching completion (see CIVIL ENGINEERING, October 1948, p. 42). The reduced weight (380,000 lb as compared to about 875,000 for steel) led to considerable savings in shipping costs, and the fact that no paint is needed gives long-term reduction in maintenance costs. The main arch (seen below) is a built-up box section 54 × 32 in., with two web plates, four angles and two cover plates. The span is 290 ft from center to center of skewbacks, with a 47-ft 6-in. rise measured to center line of arch. Special problems in design and construction, such as riveting techniques and allowances for relatively high expansion of aluminum as compared to steel, were solved by research engineers of the Aluminum Co. of Canada, Aluminum Laboratories, Ltd., and Dominion Bridge Co. (fabricators and erectors).



EXCAVATION for depressed three-track trainway in downtown El Paso, Tex., is made in two 12-ft lifts between permanent steel sheetpile walls. Wales and struts were placed after excavation of first lift. Trainway 45 ft wide is built in 50-ft right-of-way; hence use of steel sheet piling for walls, instead of reinforced concrete, which would require greater width.

Railroad Grade Crossings Eliminated in El Paso, Texas

J. E. LINDEN

Staff Engineer, DeLeuw, Cather & Co., Consulting Engineers, Chicago

TRAFFIC in the business area of El Paso, Tex., will soon be freed from the frequent delays caused by numerous trains crossing its eight main north-and-south streets. This major undertaking, known officially as the El Paso Grade Crossing Elimination Project, consists of eleven construction contracts ranging from $55,000 to $1,365,000 for an estimated $5,500,000 total.

Briefly, the project includes the following major features:

1. Construction of a half-mile-long depressed track area 45 ft wide and 26 ft deep, containing three tracks which will handle the rail traffic formerly handled on four main-line tracks at grade. Increased track capacity will result from the installation of a modern control system operated from new Centralized Traffic Control towers at each end of the project. These towers will control all main-line trains in the El Paso operating area.

2. Construction of eight highway bridges spanning the depressed track area and installation of a track drainage system with a pumping station and a storage reservoir of 16,000-cu ft capacity.

3. Construction of permanent track changes and extensions to the main receiving and departure freight yards located east of the downtown area. A new 20-span bridge known as the Cotton Avenue Overpass will eliminate the existing hazardous grade crossings through the freight yards. Also in connection with the permanent track changes, a reinforced concrete twin-barrel culvert and a timber-pile trestle will carry rail traffic across the Franklin Canal, an irrigation channel.

BEFORE EXCAVATION for trainway was started, 42-ft 38-lb per sq ft Z-piles were driven 17 ft below new track level. Piling forms permanent retaining wall on each side of depressed track area. Acquisition of additional right-of-way to construct conventional reinforced concrete walls would have involved prohibitive cost.

Fifty-Year-Old Problem

The rail-vehicular traffic problem in El Paso is typical of similar problems in many cities. Railroads have played a major role in the development of many cities and towns across the country, and as these cities have grown and vehicular traffic increased, the conflicts of railroad-highway intersections have become more and more serious.

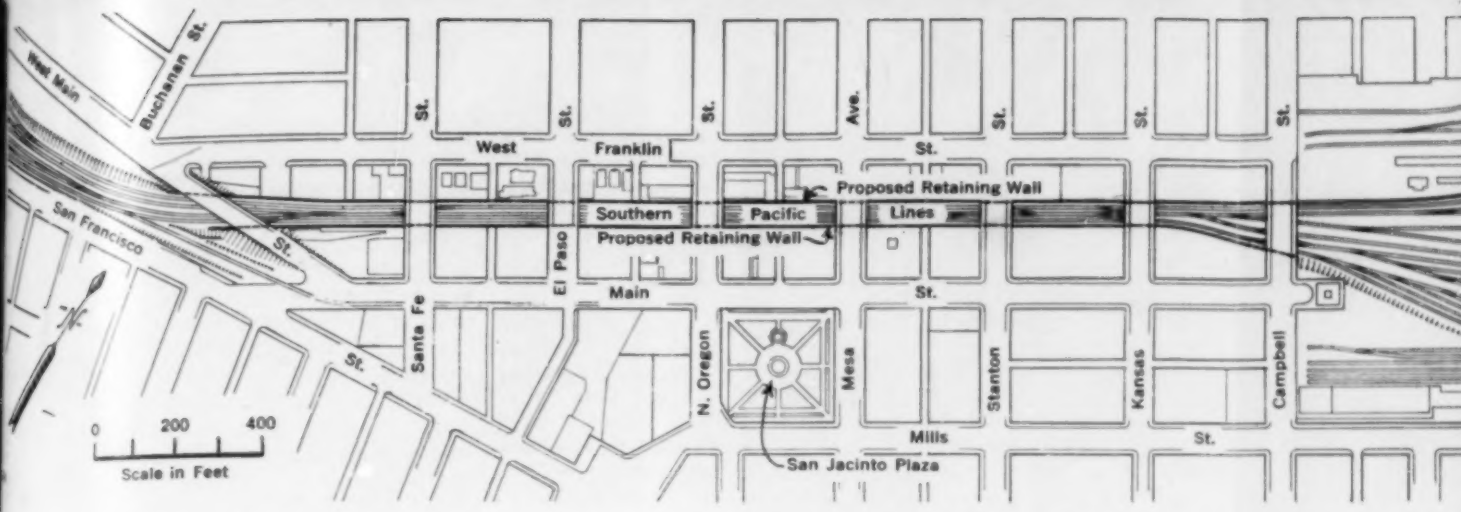


FIG. 1. **DOWNTOWN TRAINWAY** half mile long, 45 ft wide and 26 ft deep, carries three tracks under eight major streets in El Paso, Tex. Project totaling $5,500,000, divided into eleven major construction contracts, is expected to be completed in 1950.

El Paso citizens have been considering this problem since the turn of the century. In 1901 the City Council adopted an ordinance requiring the railroads to separate grades in the downtown area. Similar ordinances and resolutions were adopted periodically through the years that followed, but prior to 1946 the railroads, the city and the Texas Highway Department could not effect an agreement regarding a satisfactory solution to the problem or a method of financing.

In 1946 the City of El Paso and the several railroads agreed that an engineering firm should survey the situation and that all parties would abide by the recommendations of the engineers. DeLeuw, Cather & Co. of Chicago was selected with the approval of all parties concerned. The railroad companies involved were the Southern Pacific, the Texas and New Orleans, the El Paso and South Western, the Texas and Pacific, and the El Paso Union Depot Co., which is jointly owned by the railroad companies.

Three Possible Solutions Studied

The study revealed three possible solutions:

1. Relocation of tracks to the south side of the city near the Rio Grande River.

2. Elevation of tracks along existing right-of-way, with vehicular traffic crossing the right-of-way via underpasses.

3. Track depression along existing right-of-way, with vehicular traffic crossing the right-of-way via overpasses.

Plan 1 offered little more than a relocation of the present problem. Moreover, the estimated cost of construction, approximately $9,000,000, was considered prohibitive. In addition, train mileage would have been increased and shop and yard facilities would have had to be relocated.

Plan 2, proposing that the tracks be elevated from 3 to 10 ft above existing grade, and requiring that street grades be lowered some 8 to 15 ft, would make access to business properties fronting on these streets virtually impossible. The estimated cost of construction under this plan was $5,130,000.

Plan 3, estimated to cost $5,500,000, proposed the lowering of tracks approximately 26 ft below the present grade and allowing cross streets to remain at existing grade with little resulting property damage.

The track depression project, Plan 3, was recommended and agreed to by the City of El Paso, the Texas Highway Department and the several railroads. The Highway Department agreed to participate in the cost of construction to the extent of $1,500,000, the city shouldered a $2,000,000 share, and the railroads accepted the obligation to absorb the remaining $2,000,000.

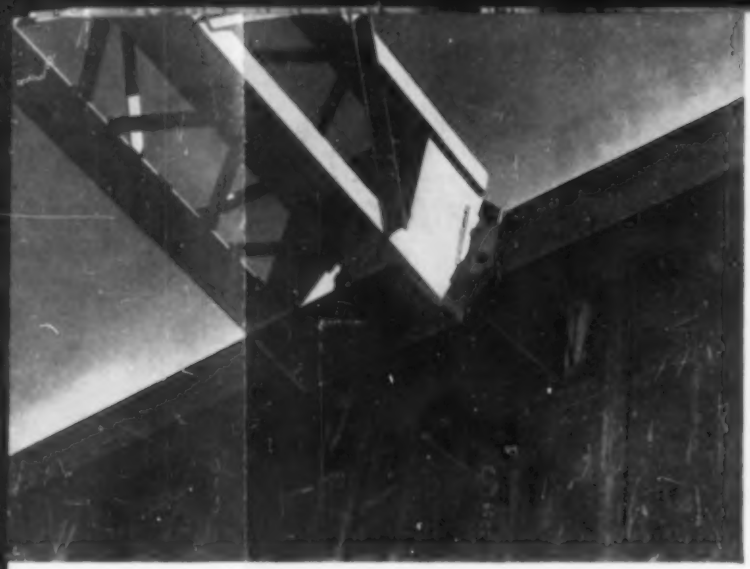
Separation of Contracts Speeds Construction

Surveys were started early in 1947 and completed in April of the same year. Plans and specifications were also started early in 1947 for the entire project. In August of that year the engineers suggested breaking the project down into separate contracts for the following reasons:

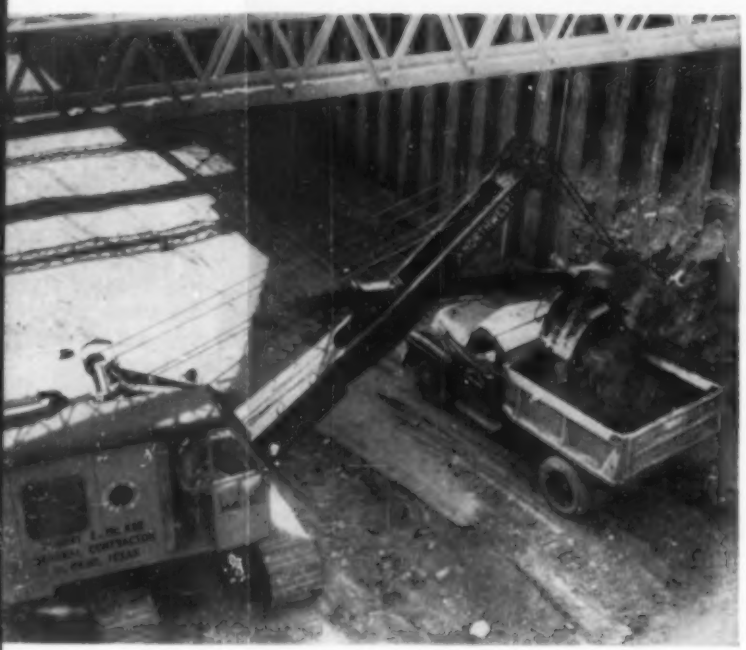
1. Construction could get under way in a natural sequence of timing as soon as plans and specifications for a given contract were completed, without waiting for completion of plans for the entire program.

2. Contractors who could handle expeditiously a $5,500,000 contract were relatively few. Breaking the project down into several contracts gave the smaller contractors an opportunity to bid on the work, thus stimulating competition.

CONCRETE TRACK DRAINAGE gutters, built along each sheetpiling wall, lead to 100,000-gal sump at low point, emptied by four 1,500-gpm electric pumps. At each end of cut, an auxiliary sump will intercept storm water entering depressed area.



WELDED LATTICED STRUTS spaced 24 ft on centers span trainway excavation between wales to take top-of-wall thrust. In erection sequence, clip angles were welded to pile tops; then wale was placed, drilled, and bolted to angles. Note stiffeners, which were welded to piles and to wales.



POWER SHOVEL digs second 12-ft lift with $^3/_4$-cu yd bucket at rate of 1,400 cu yd per 8-hour shift. Shovel is powered with three-cylinder G.M. diesel.

frame sheds to a seven-story brick office building, are located within a few feet of the right-of-way lines on each side of the cut. The limited right-of-way, the proximity of these buildings to the right-of-way, and the support of such structures during and after construction of the depressed track area precluded the use of reinforced concrete retaining walls of conventional design. Acquisition of additional right-of-way to construct walls of conventional design would have involved a prohibitive cost. Since steel sheetpiling would be required on each side of the cut to protect the buildings during construction, a design was developed by which the sheetpiling was utilized as the permanent retaining wall.

This procedure was accepted and Contract No. 1, construction of temporary trackwork to remove rail traffic from the depressed-track area, was awarded to the Hugh McMillan Co. of El Paso, in March 1948. Plans for the final contract, Contract No. 11, were completed in November 1948. If it had been necessary to have plans for the entire project completed before the award of any contract, the start of construction would have been delayed at least eight months.

Design and Construction of the "Cut"

Contract No. 2, the largest in the project, was awarded to the Robert E. McKee Co. of El Paso, in July 1948, for a total figure of $1,365,000. In addition to being the largest single contract, it also contains the most unusual design and construction features—the construction of a three-track depressed roadbed in an existing right-of-way about 50 ft wide.

Buildings of varying heights and types of construction, from one-story

Soil samples from an open test pit and Gow soil borings were analyzed to determine physical characteristics and chemical content. No corrosive elements were found. Recognizing the possibility of future electrolytic action, however, an electrolysis survey has been made and positive means developed to divert stray currents which may develop in the future.

Comparative estimates of cost indicated that concrete-faced steel sheetpile walls with a wale and strut system of bracing would be much cheaper to construct than concrete walls. The construction period also would be shortened considerably.

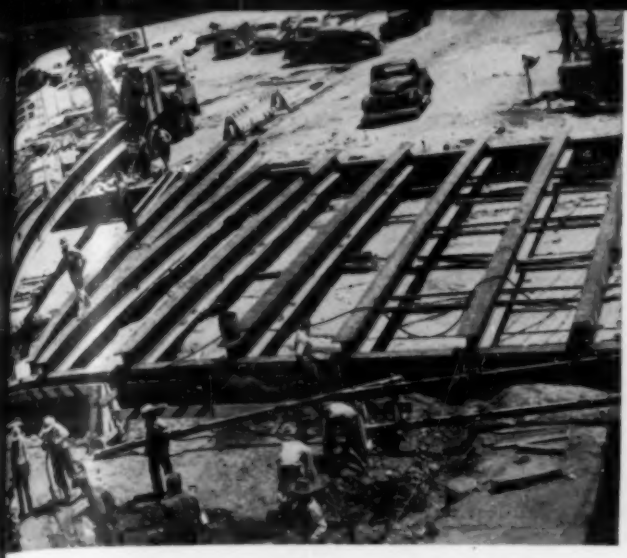
The retaining walls consist of Z-type steel sheetpiling, Carnegie-Illinois sections MZ-32 and MZ-38 of an average length of 42 ft. The MZ-32 section was used where no surcharge or building load would be encountered on the back side of the wall. The MZ-38 section was used where the maximum load on the back of the wall would be that of a one-story brick building. Higher structures were shored and underpinned to remove their weight from the retaining walls. The foundation loads of these buildings were carried to the depth of the new track subgrade by cast-in-place concrete T-shaped piers wedged up under the building foundations.

Thrust against the back of the retaining walls was taken in part by the resistance of the earth mass below subgrade, and the remainder by a system of struts spanning the cut between wales along the tops of the pile walls. The wales are 24-in. WF beams in 24-ft lengths bolted to 6-in. clip angles which are welded to the tops of the piles. Welded, latticed steel struts are located at each joint between wale sections. The struts span the cut from wall to wall.

Steel Sheetpiles Driven 17 Ft Below Grade

To expedite drilling of bolt holes in the 24-in. wales which were to be attached to the top of the pile wall by clip angles, the contractor built an air-powered, portable gang-drill that could be rolled along the flanges of the wales. The drill could also be rotated to fit the position of each of the clip angles, which had been previously welded to the piling. A job-built two-way level marker was so constructed that when the lower portion of the marker was spotted in the bolt holes of the clip angles on the under side of the wale web, the upper portion of the marker spotted the location of these holes on the upper face of the web. With the positions of the clip-angle holes thus marked on the wale web, the gang-drill moved into position over the marks. When the holes had been drilled, the wale was bolted into place.

Piles were driven by two McKiernan-Terry 9B3 rigs, one on each wall driving through from the west to the east end of the project. Only one cross street at a time was closed during pile-driving operations. As soon as the piles were driven to grade, temporary crossings were constructed and the streets reopened to traffic. The piles were driven to



TICAL CROSS STREET is carried over trainway on single-span eam bridge. Above, erection crew for Santa Fe Street Bridge aces and welds steel prior to excavation. View at top right shows idge abutments, which are formed by sheetpile walls which line cavation and by H-piles driven in recesses behind walls. At ver right completed bridge with concrete pavement and sidewalks een, with latticed strut in foreground carrying utility pipe.

netrate approximately 17 ft below e new elevation of top-of-rail. This gth was necessary to take the de- ed part of the thrust against the ck of the wall.

Sheetpiles Driven to Close Tolerances

Sheetpiles were set up 100 ft in rance of the two driving rigs by a if-leg derrick with a 90-ft boom and ven to a penetration of 10 ft with ry fifteenth key pile driven to a pth of 20 ft. The allowable toler- ce in vertical alignment was $^1/_{16}$ per ft, with a maximum allowable splacement of 2 in. toward the ck at top-of-rail elevation. These itations were necessary to ensure a inimum coverage of $3^1/_2$ in. of con- te facing on the sheetpile wall at p-of-rail elevation without en- aching on the vertical track-clear- ce line $8^1/_2$ ft from the center line of track.

Although 2,682 sheetpiles were ven, only in two places was the aximum allowable displacement und to have been exceeded after ex- vation was completed to subgrade. these two locations, an inverted notch was cut in the side of the ling, the dirt excavated from behind e wall, and the pile then jacked back to position. The pile sheet was then tched and a plate welded across it r reinforcement.

Boulder Stratum Under Piles Excavated

Only one major obstacle was en- untered during the entire pile- ving operation. Near the west d, a subsurface stratum of boulders as encountered 20 to 26 ft below the ound surface. The stratum varied thickness from 5 to 9 ft and ex- ded along the full width of the de- pressed track area for a distance of 450 ft. The piles in this area were driven to refusal at the top of the boulder stratum and the dirt between the two pile walls was excavated to a depth of 12 ft. A secondary line of timber piling was then driven 9 ft in from the face of each of the steel pile walls. The earth between the timber piling and the steel piling was excavated by clamshell. As the excavation progressed, the steel pile wall was braced against the timber wall with 8 × 8-in. timber struts on 9-ft centers resting against 8 × 8-in. wales along each of the walls. The boulder stratum was then excavated by laborers with picks and shovels. After the boulder excavation was completed, the trenches along each wall were backfilled and tamped and the steel piles were driven to the required penetration.

Safety niches to afford refuge for track crews working in the cut and to allow for expansion and contraction in the pile wall, are located at the alleys between cross streets so that they are about 300 ft on centers. The niches, 16 ft long, vary in depth from 3 ft 6 in. to 7 ft. The walls of the niches were formed by driving the sheetpiling around their rectangular perimeters with special fabricated piles at each of the four corners of each niche.

A pumphouse and drainage sump is located at the low point of the depressed track area. Concrete track-drainage gutters located along each wall of the cut at subgrade elevation carry the storm water to a sump of 16,000-cu ft capacity which spans the cut. The track sump is built so that a maintenance crew can enter it to clean out accumulated sand and silt without interference with normal railroad operation.

Pumps Discharge Into Storm Sewer

The pumphouse has four 1,500-gpm electrically driven centrifugal pumps to drain the sump and discharge the water into the new storm sewer in Franklin Street about a half block north of the cut. One 3,000-gpm gasoline-driven standby pumping unit with automatic starting equipment is provided to prevent flooding during a power failure.

The steel sheetpile walls are to be faced with concrete varying in depth from a minimum of $3^1/_2$ in. to 18 in., this variation being caused by the recesses in the pile section used. Expansion joints in the concrete facing are provided at the property lines of the cross streets and at the safety niches. The concrete facing is to be

applied to the walls after the piles have attained their final set, estimated to occur about one year after completion of pile driving. Berry strain-gage readings taken on the struts, and precision measurements of wall deflection will be made periodically to determine when the final movement of the pile walls has been attained. During the first half year, movement has been negligible.

Excavation for the depressed track area was made in two lifts of approximately 12 ft each. After the first 12 ft of dirt was excavated, the wales and struts were erected and the excavation was then carried down to the final subgrade elevation.

Bridges Built Before Excavating Cut

Of the eight streets which will cross the cut, six will be carried on single-span bridges. The bridges are about 47 ft long with 50 ft of pavement and two 10-ft sidewalks making up the width of 70 ft. Bridge superstructures have 6-in. concrete decks supported on 24-in. and 30-in. WF stringers. Utilities such as water, gas, electric, telephone and telegraph lines, are carried across the cut in or under the bridge sidewalk slabs. Bridge rails are solid concrete with simple architectural treatment. Wrought-iron locomotive blast plates are provided on the under side of the bridges along the center line of each of the three tracks.

Bridge abutments are also of unusual design. On the back of the pile walls in the recesses in the piling, 10-in. H-section bearing piles were driven to grade, which, together with the sheetpiling, form the bridge abutments. The wall wales are connected to the outer bridge stringers and separate bridge wales are used at the abutment sections. Eleven H-piles were driven at each abutment, one for each end of each bridge beam.

Contract No. 2 is now approximately 75 percent complete. The sheetpile walls, together with the struts and wales, the excavation between the walls, and the six typical bridges, are all completed. A 16-in. gas main spans the cut on a separate steel bridge at strut level. Other separate steel bridges were constructed between streets to carry electric cables across the cut.

Contract No. 3, covering construction of the approaches and approach slabs for the six typical bridges and construction of a wall drainage system outside the track cut, was awarded to the Vowell Construction Co. of El Paso. The wall drainage system consists of a paved concrete gutter along the north side of the north retaining wall with inlets and sewers connecting to the storm sewer system, the natural ground slope being from north to south. This contract is approximately 70 percent complete.

At the west end of the track depression, where the tracks swing into the El Paso Union Depot, a 70-ft-wide bridge 155 ft long is being constructed under Contract No. 4, awarded to the Western Constructors, Inc., of El Paso. The bridge, a double-span through-girder design, has a 26-deg skew at the northerly end and a 36-deg skew at the south. The bridge deck is $4^1/_4$-in. I-beam Lok flooring filled with concrete. The abutments, center pier, and wing walls are all reinforced concrete, constructed under Contract No. 2.

The bridge is located at the end of the cut where the tracks come back to existing grade. The problem of maintaining 22 ft of vertical clearance over the tracks and meeting existing pavement grades of intersecting streets at each end of the bridge was solved by providing a split pavement with a center retaining wall. The approaches and pavement of the streets adjoining this bridge will be constructed under Contract No. 10.

The two Franklin Canal crossings and revisions to two of the bents of the Austin Street viaduct (an existing overpass over the freight yards east of town), were performed under Contract No. 5, awarded to Robert E. McKee Co. of El Paso. Permanent track changes in connection with Contract No. 5 are being performed by railroad company forces at an estimated cost of $950,000.

Centralized Traffic Control Towers

The two new centralized traffic control towers which will govern rail operations over the main lines in El Paso were constructed under Contract No. 6 by J. E. Morgan & Sons of El Paso. Each tower is a two-story brick and concrete building with the first floor housing the battery room, relay racks, cable raceways and miscellaneous signal equipment. The second floor houses the control machine with a modern illuminated track diagram. About 75 percent of the wall area on the second floor is Solovex heat-resisting glass to give the tower operator a clear, unobstructed view up and down the track. The roof has a wide overhanging eave line providing adequate shade from the bright sun, and the tower is also air conditioned for operator comfort.

Equipment for the two towers and the signal equipment is being provided under Contract No. 7, a purchase contract which was awarded to the Union Switch and Signal Co. of Swissvale, Pa., at $335,000. Equipment for the entire project is being installed by the signal forces of the Texas and New Orleans Railroad Co. by separate agreement among the several railroads concerned.

Permanent track changes at the east and west ends of the depressed track area and two auxiliary drainage sumps are to be constructed under Contract No. 9. The sumps, located at each end of the cut, will intercept storm water entering the ends of the cut and discharge it into lift stations nearby, which were constructed as a part of the city's $1,680,000 storm sewer project. Contract No. 9 has not yet been awarded since other construction has not advanced to the point where work on it can proceed without delay.

At the east end of the depressed-track area, the eighth downtown bridge, a 90-ft long, 70-ft-wide double-span structure, is to be built under Contract No. 10, which was awarded to Western Constructors, Inc., of El Paso at a total cost of $153,000. The bridge deck is a 6-in. concrete slab supported on 24- and 30-in. WF stringers. The abutments, center pier and wing walls of this bridge were built under Contract No. 2 as part of the cut retaining walls. The low bearing capacity of the soil at this location required H-section bearing piles about 60 ft long, driven to subgrade elevation.

Cotton Avenue Overpass Spans Freight Yard

The firm of Bell, Braden, Barker and Gilvin of Amarillo, Tex., was awarded Contract No. 11, the Cotton Avenue Overpass, which is the largest bridge in the project, for the sum of $412,000. This bridge spans the large receiving and departure freight yards at the east end of El Paso and will eliminate a long and hazardous series of existing grade crossings. Twenty spans will make up the 970-ft length of the structure, which has two 24-ft roadways, a 4-ft median strip, and 6-ft walkways on each side. The approaches are to be on fill held within the existing street right-of-way by reinforced concrete retaining walls. Retaining walls were selected instead of approach fills with conventional side slopes because of interference with adjacent buildings and the need for access to these buildings.

Project Engineer for DeLeuw, Cather & Co. in El Paso is Harlan H. Hugg. The writer served as Project Manager in Chicago. The job is expected to be completed for train operation late in 1950.

Air Entrained in Fast Water Affects Design of Training Walls and Stilling Basins

D. B. GUMENSKY, M. ASCE
Knappen Tippetts Abbett Engineering Co., New York, N. Y.

WATER FLOWING over a spillway crest proceeds down the slope at a gradually increasing speed but because of friction its ultimate velocity is restricted. After accelerating down a sufficient distance, water will entrain air and white water will result. The entrainment of air varies with the velocity of the flow and, combined with the uncertainty of the Manning or similar formulas for friction losses on extremely steep slopes, makes if difficult to determine the actual velocity and the depth of flow on the face of a spillway or in a chute. Yet both the velocity of the water and the amount of air entrained must be estimated by the designer before he can decide on the height of the training walls forming the sides of the spillway or steep chute or determine the dimensions of the required stilling basin at the end of the spillway slope. The charts and discussion in this article are the result of study and design experience on the subject by the author and his associates, John de Arrieta, James J. Doody, and Harold Fong, all Juniors ASCE.

Depth of Flow on Spillways

In spite of the uncertainty and inaccuracy involved in determining the coefficient of roughness, the Manning formula still appears to be the best approach to the solution of problems involving the flow of water in open channels. Its usual form is

$$V = \frac{1.486}{n} r^{2/3} s^{1/2} \quad \ldots\ldots (1)$$

where V is velocity in feet per second, n is the coefficient of roughness, r is the hydraulic radius, and s is the hydraulic slope equal to the drop in energy gradient of the stream per unit slope length of the channel. For a wide sheet of flowing water, the effect of the side walls on the wetted perimeter is small and the depth of flow d may be used in place of the hydraulic radius r, so that Eq. 1 becomes

$$V = \frac{1.486}{n} d^{2/3} s^{1/2} \quad \ldots\ldots (2)$$

The relationships shown in Eqs. 1 and 2 are for terminal conditions, where constant channel form and slope have continued for such a distance that acceleration has ceased, and all available energy is being consumed in friction. This condition does not apply to the upper reaches of a spillway chute or the face of an overflow dam. The velocity in such regions is determined from the relationship $V = \sqrt{2gh'}$, where g is the acceleration of gravity and h' the total drop from headwater energy gradient to the water surface at the point in question, less friction losses and head converted into turbulence in the intervening distance.

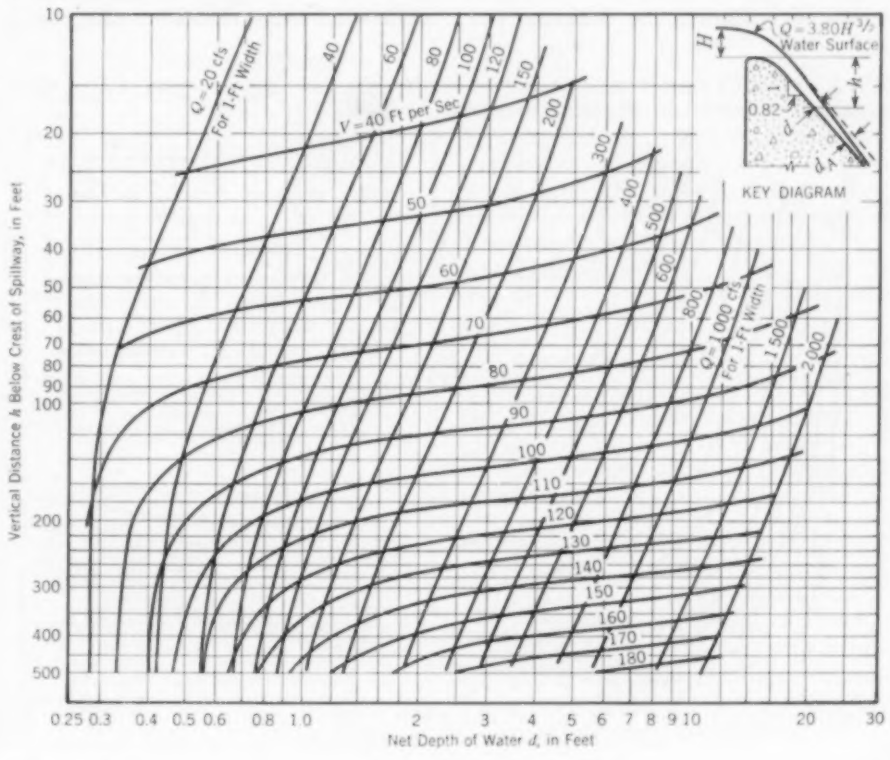
Computation of Friction Loss

The suitability of the Manning formula for estimating friction in accelerating flow is not established, but in the absence of something better it is generally used. In proportion to other uncertainties, the resulting inaccuracy is doubtless negligible. The computations are accomplished by solving Eq. 1 or 2 for the friction slope, and deducting the corresponding head loss from the total fall, in a step-by-step procedure, or by proceeding in any manner suitable for backwater curves in general.

It is a well-known fact, and also evident from Eq. 2, that increasing the depth in a solid stream (no entrained air) reduces the friction loss for a given velocity. This has also been found to be true where the increase in depth results from the entrainment of air. Whether the mathematical relationships between depth, velocity and friction are the same for solid and air-entrained streams is not known.

It is usual to compute friction losses on the basis of the net value of d, as it would be if there were no entrained air, and to allow for the reduction due to increased depth by altering the value of n. Hall found that values of n applied to the net depth of flow vary between 0.008 and 0.011. The engineers of the Bureau of Reclamation used $n = 0.008$ in computing entering velocities of stilling basins and in determining the trajectory limiting vertical curves.

FIG. 1. CURVES show actual velocity and solid-water depth on face of spillway for various quantities of flow.


Vertical Distance h Below Crest of Spillway, in Feet
Net Depth of Water d, in Feet
Q = 20 cfs For 1-Ft Width
V = 40 Ft per Sec
Q = 1000 cfs For 1-Ft Width
Q = 3.80H^3/2
Water Surface
KEY DIAGRAM
0.82

HIGH-SPEED FLOW over spillway causes air entrainment and bulking of water. Engineer's problem is to determine how much volume is increased so that training wall height can be determined. View of Grand Coulee Dam spillway also shows dissipation of energy in hydraulic jump at toe. Photographs on this page are courtesy of U.S. Bureau of Reclamation.

AMOUNT OF AIR ENTRAINED in water flowing in open channel varies with velocity. Discharge shown in wasteway of Kittitas Main Canal, Yakima Project, Washington, is 922 cfs and slope is 30° 10′.

The study of all available data in the U.S. Engineer office at Sacramento, Calif., led to the conclusion that for the computation of velocities and net depths of water on the face of an overflow spillway, the Manning formula with $n = 0.008$ should be used. A summary of such computations prepared in that office is shown in Fig. 1, in the form of a chart for a range considered sufficient for most actual problems.

Chart Gives Velocity and Depth

For a given discharge per 1-ft width of spillway, the designer can determine the actual velocity and the net depth of water at a desired point on the face of a spillway. The use of the chart saves time and effort in cut-and-try computations for non-uniform flow. As the velocity of water increases with the drop, the resistance to flow increases as the square of the velocity until the drop in elevation per unit length is equal to the friction loss. At this point the non-uniform flow becomes a steady uniform flow until it reaches the bottom of the dam. The chart, Fig. 1, showing only the net depths of water, is not sufficient for the designer, who needs to know the actual depth of flow, including entrained air so that he can determine the height of training walls on the sides of a spillway.

In order to allow for bulking from entrained air, the Bureau makes a second computation of flow in the chute or on the face of the spillway using this time the coefficient of roughness $n = 0.014$. This gives a fictitious velocity which is too low, but it is generally agreed that the depth will be fairly correct for the combined air and water. In studying the results of the measurements and observations by the late L. Standish Hall, M. ASCE, the conclusion was reached that the ratio of entrained air to water varies as some ratio, or "kinetic flow factor," equal to V^2/gd, in which V is the velocity of the flow, g is the acceleration due to gravity, and d is the net depth of flow.

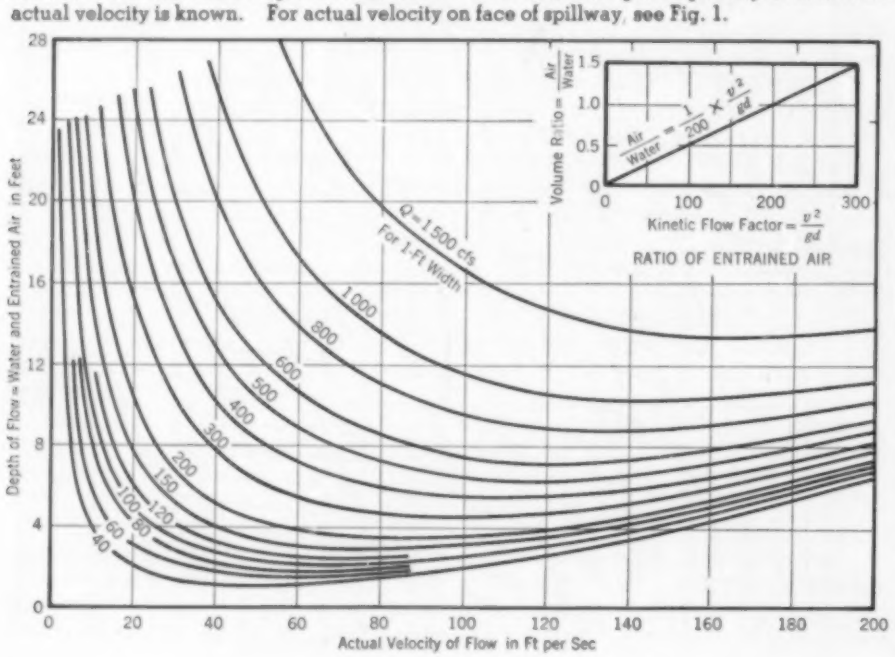
Sometimes this kinetic flow factor is called the Froude number, which however is incorrect since the Froude number equals the square root of the kinetic flow factor.

From a careful analysis of Hall's data, made in the Sacramento office of the U.S. Engineer Department, a formula for air entrainment was deduced, as follows:

$$m = \frac{V^2}{200\,gD} = 0.000\,155\,\frac{V^2}{D} \quad ..(3)$$

where m is the ratio of the volume of entrained air to water. This equation is derived from data for flow over good concrete surfaces. It probably varies with surface roughness. Figure 2, showing curves for different quantities of flow per foot width of

FIG. 2. CURVES show depth of combined air and water for given quantity of flow when actual velocity is known. For actual velocity on face of spillway, see Fig. 1.



channel, and giving the relationship between the depth for combined air and water and the actual velocity of water, is based on Eq. 3.

Thus, in Figs. 1 and 2 the designer has the means for estimating the actual velocities of the flow on the face of an overflow spillway and the corresponding probable depths of water, including the entrained air.

The height of training walls should include an ample freeboard allowance, preferably not less than 100 percent of the computed entrained air plus 5 ft. This design would conform to present conservative engineering practice.

Effect of Air Entrainment on Hydraulic Jump

At the toe of a dam, water attains very high velocities, which increase generally with the height of the fall. The erosive and scouring capacity of such fast-moving water is very high and may be sufficient to excavate and carry away not only sand, gravel, and boulders but even blocks of sound rock. To provide safety and to prevent excessive erosion below a dam, the excess energy in the water must be dissipated. An efficient means of so doing is the hydraulic jump, formed in a specially designed stilling basin. To proportion the dimensions of the stilling basin, the designer must know the depth of water before and after the hydraulic jump. Having determined the actual velocity and net depth of the water before the jump from Fig. 1, the designer can determine the velocity and depth of flow after the jump from Fig. 3.

In determining the depth of flow after the jump by this method the designer may question this usual procedure of design, which ignores the effect of the air admixture on the flow upstream of the hydraulic jump. The volume of air drawn into the stream depends on the velocity of the flow and may be equal to, or even exceed, the net volume of water. This air entrainment would affect the horizontal static water pressure acting on the jump. The effect of air entrainment on the hydraulic jump in a horizontal rectangular channel is negligible for practical design, as will now be shown.

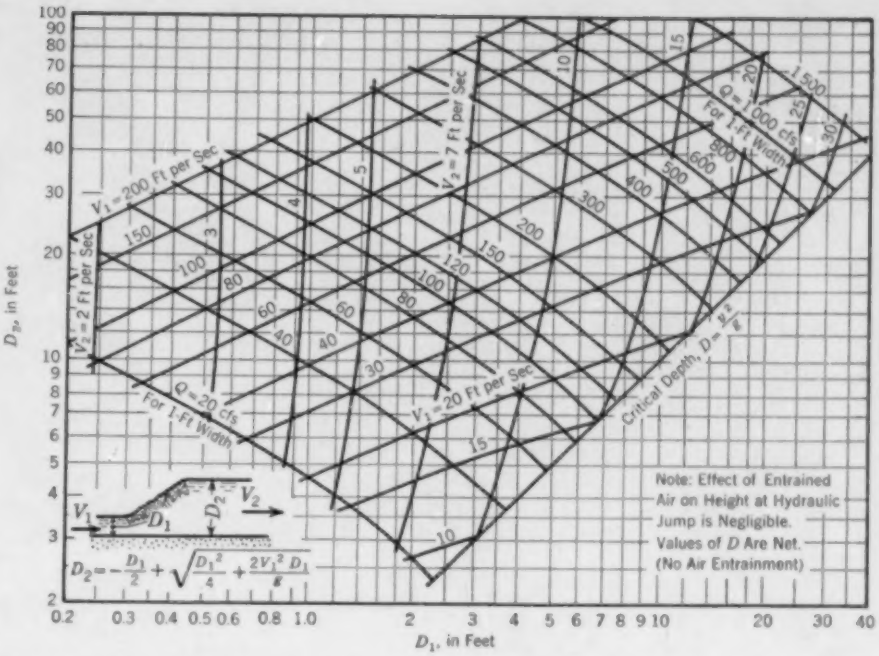

D_2, in Feet
D_1, in Feet
V_1 = 200 Ft per Sec
V_1 = 20 Ft per Sec
V_2 = 7 Ft per Sec
V_2 = 2 Ft per Sec
Q = 20 cfs For 1-Ft Width
Q = 1,000 cfs For 1-Ft Width
Critical Depth, $D = \sqrt[3]{q^2/g}$
Note: Effect of Entrained Air on Height at Hydraulic Jump is Negligible. Values of D Are Net. (No Air Entrainment)
$D_2 = -\frac{D_1}{2} + \sqrt{\frac{D_1^2}{4} + \frac{2V_1^2 D_1}{g}}$

FIG. 3. CURVES show depth and velocity of flow after hydraulic jump for given depth and velocity before jump as determined from Fig. 1.

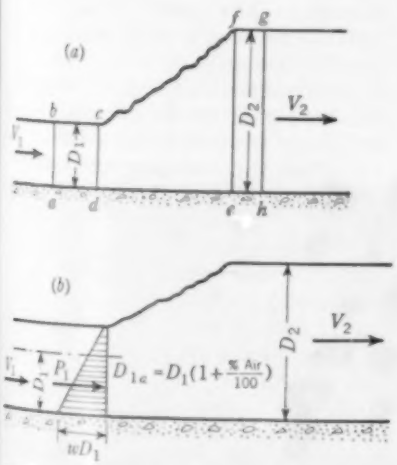


FIG. 4. DIAGRAM shows hydraulic jump relationships for (a) white water entering jump, and (b) solid water entering jump.

In Fig. 4(*a*) is shown the hydraulic jump without air entrainment, where the water flowing at a velocity of V_1 and a depth of D_1 jumps to a depth of D_2 with a corresponding velocity of V_2. Consider that the mass of water, $M = abcd$, moves to position $efgh$, thereby losing momentum because of the decrease in velocity. The loss of momentum per unit of time t must be equal to the unbalanced force F acting on the mass to retard its motion, or

$$F = \frac{M(V_1 - V_2)}{t} = \frac{Qw}{g}(V_1 - V_2)$$

where Q = rate of discharge of water, w = unit weight of water, and g = gravitational acceleration. At the same time the unbalanced force is equal to the difference between the hydrostatic pressures above and below the jump, or

$$F = {}^1/_2\, wD_2^2 - {}^1/_2\, wD_1^2$$

Equating the two expressions for the unbalanced force, substituting $V_2 = Q/D_2$, and transposing and substituting $g = 32.16$, the hydraulic jump formula ignoring air entrainment can be written,

$$D_2^2 = 0.06219\, QV_1 + D_1^2 - 0.06219\, \frac{Q^2}{D_2} \quad \ldots (4)$$

The procedure and reasoning in the derivation of the hydraulic jump formula including air entrainment are

(*Continued on page 93*)

STUDIES AND EXPERIMENTS

"Recent Studies on Flow Conditions in Steep Chutes," E. W. Lane, M. ASCE, *Engineering News-Record*, Jan. 2, 1936. Describes U.S.B.R. design procedure based on actual measurements.

"The Hydraulic Jump in Terms of Dynamic Similarity," B. A. Bakhmeteff, Hon. M. ASCE, and A. E. Matzke, Assoc. M. ASCE, TRANSACTIONS of ASCE, 1936, p. 9630.

"Open-Channel Flow at High Velocity," L. Standish Hall, M. ASCE, TRANSACTIONS of ASCE, 1943, p. 1394.

"The Hydraulic Jump in Sloping Channels," C. E. Kindsvater, Assoc. M. ASCE, TRANSACTIONS of ASCE, 1944, p. 1107.

"Dimensions for Stilling Basins," E. W. Lane, M. ASCE, *Handbook of Applied Hydraulics*, McGraw-Hill, New York and London, pp. 347–351.

COMPLETED SECTION of Eastshore Freeway, Oakland, Calif., illustrates modern concepts of urban arterial highway design. Median strips, long sight distances, and elimination of grade intersections speed traffic safely to its destination. Cost of improving National System of Interstate Highways, estimated at over 11 billion dollars, is insignificant when compared to number of lives that could be saved.

Over Eleven Billion Dollars Needed to Improve Interstate Highway System

From Paper Presented Before Highway Division at Washington, D.C., Fall Meeting

THOMAS H. MacDONALD, Hon. M. ASCE
Commissioner of Public Roads, Washington, D.C.

OF THE 31,831 miles of the National Interstate System of highways in rural areas, 29,931 miles require improvement to bring them up to standards recommended for existing volumes of traffic. Of the 5,969 miles of roads and streets in urban areas, 5,571 miles require some degree of improvement. Of the 10,050 bridges on rural sections of the system, only 483 are completely adequate. Although the system includes only 1 percent plus of the country's total mileage of roads and streets, its rural sections, if adequately improved, would serve more than 21 percent of the traffic carried by all rural roads. Its urban sections as thus far designated would serve more than 10 percent of the traffic moving over all city streets.

On its rural sections the system served an average of 2,915 vehicles per day in 1948. However, the traffic varied from a minimum of less than 200 vehicles per day on a few sections to more than 70,000 vehicles per day on one section. There were 359 miles that carried less than 400 vehicles per day, and there were 437 miles that served an average of more than 20,000 vehicles per day. Nearly half of the rural mileage—14,892 miles—served more than 3,000 vehicles per day.

The designated system connects directly all cities of 250,000 population or more, and all but six of the cities of 100,000 population or more. Of the 197 cities with populations between 50 and 100 thousand, 69 lie directly on the system, as do 2,538 other cities, towns, and urban places.

Of the total population of 83,766,000 classified as urban by the 1940 census, 54,378,000, or 65 percent, was in cities lying directly on the Interstate System. In the 1,160 counties traversed by the system, there was a rural population of 23,953,000, or 50 percent of the 1940 rural population.

Estimated Cost of Improvement

Routes in the Interstate System are most deficient in sight distance and in width of pavements, shoulders, and bridges. On the basis of construction costs in 1948, the cost of improvements to correct these deficiencies and to adapt the system to existing traffic needs is estimated at $11,266,000,000. Of this sum, approximately $5,293,000,000 would be expended on sections of the system within the urban areas of cities having 5,000 or more population, and the remaining $5,973,000,000 on rural sections of the system.

If routes in the Interstate System are to be brought to a state of adequacy in a period no longer than 20 years, a capital investment averaging probably more than $500,000,000 a year will be required.

Capital requirements of such magnitude obviously cannot be met from the annual revenues at their present levels. The improvements are needed now. Deferment means the acceptance of greater costs measured in lives, inconvenience, and in actual expense of vehicle operation. Completion of proposed improvements on the Interstate System in a period far shorter than 20 years would result in much greater economic and social benefits. The needs of the national defense require a substantially more rapid improvement.

Public dissatisfaction over highway inadequacies, traffic congestion, and accidents has prompted a marked increase in the planning and construction of major highway facilities, both rural and urban, that will form links in the Interstate System. During the past two years, progress in initiating and planning wide and safe rural highways and urban expressways has been at a greater rate than ever before.

As of October 1, $1,185,247,765 of the primary and urban funds authorized by the Federal-Aid Highway Acts of 1944 and 1948 had been assigned to programmed projects. Of this total, $362,352,522, or nearly 31

TRAFFIC VOLUME of Gulf Freeway, Houston, Tex., has increased from 28,000 to 50,000 vehicles per day in little more than one year. In estimated 50 million vehicle-miles during first year of operation, there has been only one traffic fatality.

percent, was for Interstate System improvements having an estimated total cost of $792,771,000. These improvements extended over 3,943 miles of highways—nearly 9.6 percent of the total mileage in the system. Projects for which plans were approved included 1,092 bridges and the elimination of 129 railway-highway grade crossings.

In large cities in every part of the country major projects to eliminate traffic congestion passed from preparatory stages to active construction during the past year. Important projects that have been completed are rendering spectacular service. The first 3.6-mile section of the Gulf Freeway in Houston, Tex., has been in service just over one year. When opened, the traffic was 28,000 vehicles per day. Now it has reached the 50,000-vehicles-per-day mark and is still climbing. In an estimated 50 million vehicle-miles of traffic service the first year, there has been only one traffic death. This is only one of the new values already secured. Trends of land use and values are indicated which hold promise of sound urban development with the preservation of existing property values at the heart of the business districts.

The federal policy of aiding cities in solving their traffic difficulties, adopted in 1944, and increased state participation in urban highway work, give strong reinforcement to the efforts of the cities themselves. By comparison with what was accomplished in prewar years, the volume of work on city expressways and arterial routes that will form part of the Interstate System is impressive. However, any feeling of satisfaction with the present rate of progress, or thought that traffic troubles on main urban routes will be removed in a few years, vanishes when one compares what needs to be done with the rate at which work is being completed. Within urban areas as defined by the 1944 Act, some 3,500 miles of the system need improvements at a cost in excess of five billion dollars. Construction will have to be stepped up to a much faster pace if these most needed urban improvements are to be completed within a reasonable period of years.

While the total cost of making urban improvements is large, the price that will have to be paid per mile of vehicle travel is small in comparison with the cost of tolerating the present congestion and delay. If the vehicles using urban sections of the Interstate System paid only $1\frac{1}{2}$ cents per mile of travel over a 20-year period, this would be sufficient to provide the highest type of modern highway facilities. This estimate is based upon the 1948 volume of traffic. Considering the volume of traffic that is likely to develop in the next few years, it is probable that little more than 1 cent per mile of travel would suffice.

The capital investment to provide freeways or, as some prefer, expressways, measured in terms of per-vehicle-per-day, is less than the cost for many even so-called low-cost secondary roads measured by the same yardstick.

The relation of the Interstate System to the national defense is indicated by the following excerpt from the report of the Secretary of Defense: "The National Military Establishment considers a relatively small 'connected system of highways, interstate in character,' constructed to the highest practical uniform design standards, essential to the national defense. Because of the time required, and cost, such a system must be planned for and constructed during peacetime."

Adoption of an interregional highway plan is, in effect, a major reorientation of our highway program. However, except as to size of undertaking, it does not constitute a departure from basic governmental policies successfully applied on a small scale in our early history, and on an expanding scale since the beginning of the modern period of road building, initiated by the Federal-Aid Road Act of 1916 and the Federal Highway Act of 1921.

NARROW BRIDGE ON U.S. ROUTE 5 in Vermont forces large vehicles to straddle pavement center line on this sharp curve. On rural portions of National Interstate System alone, 8,185 bridges are of inadequate width.

Coordinating Agency Initiates Program to Stimulate Research Toward Lower Costs and Better Building

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LABORATORY CONSTRUCTION at Johns-Manville Research Center utilizes movable Transite walls. This type of construction provides flexibility for expansion or contraction of laboratory areas to meet changing requirements.

COORDINATED RESEARCH has a great opportunity today to contribute to the progress of the building industry, and through it to the general well-being of the country. However, certain factors peculiar to this industry complicate the problem of organizing and conducting effective experimental programs. Through the agency of the recently initiated Building Research Advisory Board, under the direction of the National Research Council, these difficulties are being met in a way which, Dr. Rassweiler feels, will contribute to lower costs and outstanding technical progress in the building industry. His paper was originally presented before the Construction Division at the ASCE Fall Meeting in Washington, D.C.

IT HAS BECOME popular to talk about the building industry as unprogressive and to blame most of our housing difficulties on lack of technical achievement. This attitude is partly due to the ballyhoo which has led many people to expect some spectacular new discovery which will emerge full-blown from some secret research laboratory. Many people feel that research will have failed if it does not produce a house that can be erected as one opens an umbrella.

Electric lighting, inside plumbing, and central heating are major advances which happen only at long intervals. Much as we might wish for some development which would stimulate building as it was stimulated, for example, by central heating, the likelihood of our finding it in the near future is remote. Rather, we must turn to advances such as the supplying of building materials in larger and larger units to reduce site erection costs. Another line of advance already partially exploited is to make one material do the work of two. For example, asbestos siding shingles take the place of both wood siding and paint, and 4×8-ft insulating boards replace both lath and two coats of plaster on interior partitions. Great progress has also been made in supplying prefabricated units, such as door and window assemblies.

Advances have been made in reducing the cost of maintenance, both by the development of materials which require less maintenance, such as asbestos shingles and asphalt floor tile, and by modifications in design which retard deterioration and reduce cleaning and maintenance costs.

Other advances in design have been made not only through the activities of individual engineers and architects, but also by the principles of modular coordination and the cooperative efforts of industry in establishing the Industry-Engineered House. Marked innovations in assembly and erection techniques have been developed and utilized by large-scale builders in certain sections of the country. These accomplishments justify considering the building industry as aggressive in technical progress.

Peculiarities of Research in Building Field

Any consideration of methods for increasing research productivity in the building field must start with the recognition of certain basic difficulties. In the first place, the industry is composed of two totally distinct and different industries and two independent professions—the building materials industry on the one hand and the fabrication and erection industry on the other. In addition there is a design and planning phase in the hands of the largely independent architectural and engineering professions. Each of these phases has distinctly different research problems. Yet it is vitally important to coordinate research work in all three.

In the building industry there is no commercial organization, or even any

CORRUGATED TRANSITE serves equally well as roof or siding for industrial buildings. Its application in large units reduces costs.

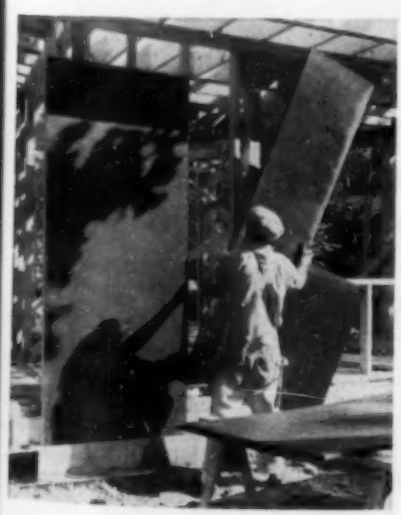
small group of commercial organizations, which are in a position to control fully the planning and conduct of all the activities resulting in a completed building, as General Motors, for example, can directly or indirectly control all the activities leading up to a finished automobile.

There are also certain technical difficulties which distinguish efforts to apply research to improving building practices. One of the major technical problems is that of setting and defining clear-cut objectives. People in Florida, Vermont, Seattle, and Los Angeles are willing to accept identical automobiles and refrigerators, but there is no sound basis for asking them to accept the same houses. Also, the success of any new building material depends to a considerable extent upon its working successfully with other materials, and these vary from section to section and from builder to builder. Building practices and skills also vary widely with the locality.

MODERN INTERIOR office construction features movable Transite walls, acoustical ceiling, asphalt tile floor.

Objectives Must Be Defined

Building research badly needs a better definition of objectives. We need an up-to-date inventory of problems which are the most urgent. Such an analysis would help those of us already in the field to spend our time more effectively. It would also enable us to solicit the help of other organizations which, at the present time, are not contributing. This fact was pointed out clearly when the Housing Research Conference started to survey the possible contribution of research in the universities. It was discovered that a great deal of work was being done by men who did not realize that their activities could be applied to advantage toward the solution of building problems.



WEATHERTITE SHEATHING, nailed directly to studding, adds bracing to frame, has no knot holes, supplies insulation, and provides a surface to which brick, wood, stucco, or asbestos siding can be applied

Another technical difficulty is that frequently the effectiveness of research in one company or one segment of the industry is greatly influenced by the effectiveness of supplementary research in other segments. It is necessary to know not only what the important research problems are, but also the adequacy of the effort which is being directed toward their solution. We need some way of stimulating activity in those areas where the effort is lagging.

The third major problem is the difficulty of evaluating new accomplishments. This is due to two circumstances. First, there has been very little systematic experimentation on erection techniques, and it is therefore difficult to get really authentic figures on the possible economies that can be achieved by the adoption of new materials or methods. For example, the Small Homes Council at the University of Illinois found in some of its studies of erection costs that the value of a new method of roof construction would have been completely overlooked if it had not been for very exact time studies. Costs were increased at that particular time by the hot weather, which caused the carpenters to spend an abnormal amount of time hunting cold water. The other difficulty of evaluation comes from the fact that there are no well-worked-out methods for predicting the actual long-time performance in service of new materials and techniques.

And finally, there is the difficulty of getting prompt utilization even of well-authenticated advances. The problem of educating architects and builders in the value of new materials and techniques is complex, both because of the number of individuals involved and because of the tremendous mass of material with which each is bombarded.

Start of Building Research Advisory Board

When the Construction Industry Advisory Council, sponsored by the U. S. Chamber of Commerce, sought ways to accelerate research in the building field, it naturally turned for assistance to the National Academy of Sciences and its agency, the National Research Council. (The Council, an independent, non-government agency, has a long history of assisting different industries in the analysis and coordination of their own research activities and in coordinating these activities with those of government agencies.) Out of this consultation grew a plan by which the Council agreed to organize a committee under its Division of Engineering and Industrial Research, to be known as the Building Research Advisory Board, and the U.S. Chamber of Commerce agreed to solicit funds to support an active program.

The Board itself, consisting of 27 representatives of all phases of the industry, is now an active functioning agency. An executive committee has been appointed and is serving to direct current programs. As a full-time Executive Director, the Board secured William H. Scheick, who, as Coordinator of the Small Homes Council at the University of Illinois, developed a research program on improved erection techniques and an educational program for Illinois builders. In addition, Mr. Scheick was

the prime mover in organizing the Housing Research Conference, which has made very real progress in coordinating and stimulating building research in the universities along much the same lines as those which the Building Industry Advisory Board intends to follow for the industry as a whole. Financial support is still inadequate for the small staff of technical field men needed to supplement Mr. Scheick's efforts, but it is hoped that additional funds will be made available as this activity becomes more widely recognized.

The Board is directly under the control of the National Research Council, which appoints its members, its executive committee, and its chairman. Although the U.S. Chamber of Commerce solicits financial support, the actual funds are handled by the National Research Council, which assumes full responsibility for the Board's activities.

The Board has the following broad objectives:

1. To determine what are the most important needs of the industry which research should attempt to satisfy, and to define these needs as clear-cut research objectives.
2. To make a survey to see how much research is being directed toward the solution of these industry needs.
3. Where work is being directed toward objectives which are of minor value, to attempt to have the work shifted to more worth-while objectives.
4. Where insufficient research activity is being carried on, to stimulate interest and persuade the logical public or private interests to undertake the needed work.
5. To foster cooperation between research organizations in different segments of the industry.
6. To advise Government and philanthropic agencies on the most effective utilization of funds they may wish to apply to research in this field, and to assist them in placing and operating research contracts.
7. To sponsor forum discussion of research aims and results and to hold research coordination meetings.
8. To assist educational institutions in initiating special programs to train men specifically for the building field.
9. To assist in and stimulate the dissemination of information regarding new technical advances in the building field.

More Immediate Aims Set

As this is a very ambitious program, the Board is setting some very much more limited objectives as a practical starting point. For its first-year program, it is hoping to organize volunteer study committees in each segment of the building industry. Each committee, by discussion with representative men in its part of the industry, will attempt to analyze the research problems whose solution is most urgently needed and to arrive at some opinion as to the adequacy of present research activities.

In addition, the Board is hoping to make some concrete progress in helping associations in the erection end of the business to start organizing experimental work among their members, particularly for evaluating new materials and erection techniques and making the results available to practicing builders. A number of research coordination forums are planned to bring together research workers with similar interests. The first such forum will deal with problems concerned with relating shelter to specific climatic conditions, since very keen interest is currently being shown in this field.

It must be remembered that the Board's activities are limited in two ways. First, it is limited to those problems where experimental research may offer a solution. The Board is not concerned with the financial and commercial problems of the industry. Second, its function is to stimulate and coordinate research; it is not organized to conduct research itself. Individuals and agencies wishing to supply funds will be assisted in finding suitable agencies to conduct the research, and the Board may act as an agent in placing and supervising the expenditure of these funds, but it will not itself operate laboratories.

There are, of course, those who believe that such a program will be ineffectual and that no real progress can be made without a radical change in the commercial and production structure of the building industry. For example, some feel that reduced costs and improved quality can only be achieved by transferring most of the man-hours of labor from the site to factory production lines—that is, by mass production of prefabricated houses. There are, however, some basic inefficiencies in factory mass production which will retard the conversion of the building industry to this basis, and which may prevent the adoption of prefabrication for more than a small amount of our housing needs.

In any event it seems unlikely that centralization of industry control through prefabrication will solve building research problems in the near future. Rather than wait for such a revolutionary solution, we must take advantage of the opportunities arising from improvement in materials and erection techniques which can be achieved within the industry's present structure. These developments can be of major importance to the prosperity of the country and the well-being of its citizens.

If this progress is to be rapid and orderly, some means must be found for stimulating and coordinating research activity in a field not well suited to effective research efforts. The problem is so great that no organization can expect to do a complete job immediately, especially with the funds that are likely to be available. However, a start must be made in the hope that by tackling the more urgent problems first, we can gradually evolve a technique and an organization which will eventually operate on a broad over-all basis. It seems difficult to conceive of any more practical way to start on this program than under the auspices of the National Academy of Sciences and the National Research Council.

ANOTHER PRODUCT of building material research is Flexboard, especially applicable to barrel roofs, arched ceilings and curved walls, where materials of unyielding rigidity cannot be applied.

Growing Population of Nation's Capital Creates Traffic Congestion in Adjoining Areas

SINCE 1940 the change in the character of the areas adjoining the District of Columbia from rural to urban has been accelerated by the avalanche of federal personnel, civil and military, which has poured into the Nation's Capital and spilled over into Virginia and Maryland. The inadequate existing highway net must be replaced with additional capacity for handling the daily traffic. Neither of the two states nor the District of Columbia appear able to raise sufficient funds for such construction from any reasonable gasoline tax. In a symposium presented before the Highway Division at the Society's Washington, D.C., Fall Meeting, the participants, whose comments are briefed here, concluded that federal assistance for needed highways in the Washington Metropolitan Area is necessary to a greater extent than now provided by law.

Maryland Proposes a Forty-Eight-Million-Dollar Highway Program

WILLIAM F. CHILDS, JR.

Chief Engineer, Maryland State Roads Commission, Baltimore, Md.

DURING THE PAST fifty years a city has grown up in Maryland on the periphery of the Nation's Capital. This city, like many others, had its origin in the satellite communities which developed along the roads radiating from the city at points chosen as stopping places for coach travel. An impetus to the growth of these communities has been given by the modern trend toward decentralization and the desire of urban residents to obtain relief from congestion. This city, the Maryland Metropolitan Area of Washington, adjoins the District of Columbia on three sides. It includes parts of Montgomery and Prince Georges Counties, and contains a number of urban areas such as Bethesda, Chevy Chase, Kensington, Silver Spring, Takoma Park, Hyattsville, Mount Rainier, Cottage City, and Bladensburg.

As the growth in this area has resulted in a boom in building and the accompanying need for such facilities as schools, churches, hospitals, amusement, shopping centers, water and sanitation, new roads and improvements to existing roads are a "must" to keep pace with the increasing traffic. The cost of new homes, water and sewer connections and other improvements is borne by the developers or other individuals, but how is the cost of the new highways to be met? The layman would answer, of course, "from motor-vehicle revenues paid to the State of Maryland." At this point it should be emphasized that not only is the out-of-state travel in this area over 40 percent of the total, but studies have shown that Maryland does not receive revenue commensurate with this travel, as many motorists purchase their gasoline in the District of Columbia, where the tax is lower than in Maryland.

Heavy Traffic in Maryland Section

Although the Washington Metropolitan Area in Maryland constitutes less than 1 percent of the entire area of Maryland, its population is 8 percent of the total population of the state, and its passenger-car ownership amounts to almost 10 percent of the entire state. In this area, the mileage of state highways is 3.2 percent of the total state system, yet almost 14 percent of the vehicle-miles of travel in the entire state occurs here. Maryland-registered vehicles account for less than 60 percent of the travel on state highways in this area.

To adequately serve the Maryland portion of the Washington Metropolitan Area, it is estimated that 125 miles of the total 145 miles of state highways in the area will require complete modernization, at an approximate cost of $48,000,000, not including the Potomac River crossings and the circumferential highways. Maryland cannot justify such an expenditure in this limited area. Even if it were feasible, many years would be required, with the funds available, before a modern highway system could be built within the area, and even then the progress of the construction would in all probability lag behind further development. Therefore it is believed that the federal government, after analysis of the Origin and Destination Survey of the Washington Metropolitan Area (recently made jointly by the District and the States of Maryland and Virginia in cooperation with the U.S. Bureau of Public Roads), should select a system of radial and circumferential facilities and construct it as a federal system from Washington to the limits

FILL PLACEMENT for Baltimore-Washington Expressway approach to Patpasco River Bridge follows removal of swamp muck by hydraulic dredge. Roadway has been completed on opposite side, awaiting building of dual-lane bridge to cost total of $675,000.

COMPLETED CONNECTION between Route 40 west of Baltimore and new link to Washington, D. C. (Route 29), is designed to meet needs of heavy traffic.

of local traffic influence. Beyond these limits the routes would be continued as state owned and maintained.

The road building program, besides providing for new roads to be added to the state system, must also make provision for the replacement of roads that are being worn out by carrying traffic for which they were not designed as well as for the mileage of roads being retired from service for other reasons.

Inadequacy of Locally Available Funds

While highway traffic is not limited to state boundaries, it is certain that the funds needed to provide for such traffic are definitely subject to these legal boundary limits. Current sources of revenue are not sufficient to meet the problem in Maryland today. After the allotment of the net income from motor-vehicle receipts and other income for highway purposes to the counties and municipalities for maintenance and for debt services, the amount available for new highway construction is far too small to rehabilitate the state highways within a reasonable period of time. Either the program must be accomplished over a longer period of time or other sources of revenue must be found. In the Maryland Metropolitan Area of Washington, it is the feeling that the federal government has some responsibility for providing additional funds for road improvement. The most desirable way of building the highways is on a pay-as-you-go basis. Needed funds can be obtained through tolls, general taxes or an increase in the revenues of motor vehicles.

In the past three years, improvements to the state highways in the Maryland Metropolitan Area of Washington have averaged approximately $1,780,000 per year, but this sum cannot be used as an indication of expenditures in the years ahead. For the sake of clarifying the problem, let it be assumed that the highway expenditures in the area can be $1,000,000 a year. The inadequacy of this sum is obvious when compared with the $48,000,000 that would be required to modernize the 145 miles of state highways in the area. To accomplish the program in ten years would require an average expenditure of $4,800,000 a year, leaving a deficit of $3,800,000 a year which would have to be provided from other sources.

Travel in the area in 1949 was about 889,571 vehicle-miles. It is customary to estimate that on the average, passenger cars obtain 15 miles of travel per gallon of gasoline. On this basis, if the deficit is to be made up from motor-vehicle revenues, an additional tax on gasoline of $0.06 per gal would be required. All of the increase in gasoline tax would not, however, be an added expense to the car owner because he would profit by the additional service and by the lower cost of operation over modern highways. In addition he would have the satisfaction that would come from operating his vehicle under more favorable conditions, without frayed nerves.

Virginia's Resources Inadequate to Build Needed Highways

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MORE VEHICLES are being driven more miles over relatively the same mileage of streets and highways in this country today. The resulting increase in traffic has brought problems under which highway and municipal administrators are reeling, particularly in the Washington, D.C., Metropolitan Area, where the influx of residents has been without parallel in the history of the nation.

In this article the Metropolitan Area will be considered as that area outside of, but adjacent to Washington, D.C., where the influence of that metropolis directly affects the lives and habits of the residents. It consists of the City of Alexandria, all of Arlington County and approximately one-half of Fairfax County, which contains approximately 80 percent of the 76,000 estimated total population of the county.

The trend from definitely rural to urban characteristics in this Metropolitan Area of Virginia was observable in the decade from 1930 to 1940. Since 1940 the trend has been greatly accelerated on account of the avalanche of federal personnel, civil and military, which poured into the Nation's Capital and which could not be contained in its congested 69 square miles, spilling over

DRIVERS LEAVE sea of parked automobiles near Pentagon Building, Arlington County, focal point for traffic from all directions.

into adjacent Maryland and Virginia. Since the end of the First World War the population of Arlington and Fairfax Counties and the city of Alexandria, Va., has increased 365 percent and has nearly doubled since 1940. The most notable of the increases occurred in Arlington County, where the population has increased 120 percent since 1940.

More than 165,000 vehicles daily cross the four bridges over the Potomac River between the District of Columbia and Virginia. Over 42 percent of these use the Fourteenth Street Bridge. More than 6,000 cross this bridge between 7:30 and 8:30 a.m. The roadway will accommodate four lanes of moving traffic, and 4,000 vehicles per hour closely approaches congestion. Needless to say, the 6,000 the bridge carries in one hour results in intolerable congestion on the approaches. The problem is no less acute on the Memorial Bridge.

Traffic across the Potomac River has increased 30 percent in the past two years and 55 percent above the prewar peak year 1941. Today, more traffic crosses the Potomac River between Washington and Virginia than crosses the Hudson between New York and New Jersey. Surely this flood of motor vehicles will reach a peak and begin leveling off, but when?

STEADY STREAM of traffic from Nation's Capital crosses Memorial Bridge. Lincoln Memorial is seen in background.

Traffic Counts Show Situation

A measure of the influence of the District on Virginia's highways is clearly demonstrated when traffic counts at 1-, 3-, 5- and 10-mile points, measured from the Potomac River bridges, are compared. Approximately 45,000 vehicles daily collect or disperse along Route 1 between the Fourteenth Street Bridge and a point one mile south. At a point five miles south of the bridge the traffic diminishes to 20,000 daily from the 70,000 using the bridge.

Over 50,000 vehicles use the Memorial Bridge daily but only 21,500 of these cross a point one mile west of the bridge. The influence of the Capital traffic is much the same on Routes 29 and 211, which cross the Key Bridge. Daily traffic declines from 38,000 on the bridge to 24,000 at the one-mile point, and to 12,000 at the five-mile point.

It therefore appears that of the 158,000 vehicles using the three bridges daily, 87,500, or 55 percent, have their origin or destination within one mile of the river crossing, and 106,500, or 67 percent, move between Washington and points five miles from the bridges.

Obviously, all the traffic using the three highways in Virginia does not cross the Potomac River bridges. Many vehicles have their origin and destination on the Virginia side. This fact, however, lends conservatism to the influence described.

In addition to the $5,600,000 spent on the Henry G. Shirley Memorial Highway and its connections, and the $1,000,000 estimated for its completion, $16,000,000 will be needed to bring the primary road system in the Washington Metropolitan Area of Virginia to a standard desirable to meet the present and foreseeable needs of traffic.

Of this $16,000,000, it has been estimated that Virginia can supply only about $400,000 annually, including federal aid. At this rate forty years will be required to meet the needs of traffic without material and increased assistance. These figures clearly show the magnitude of the highway problem in the Virginia Metropolitan Area which has been brought about by the growth of the Nation's Capital. It is evident that the limited resources of Virginia cannot satisfactorily solve this problem.

District of Columbia Highways Need Federal Financing

S. R. HARRISON

Deputy Director of Highways, District of Columbia

POPULATION GAINS in the Metropolitan Area of Washington, D.C., constitute the most important single factor having a direct bearing on plans and proposals for the improvement of urban street systems. According to a recent report of the Census Bureau, the District of Columbia experienced an increase of over 30 percent since 1940, or a total population of 860,000 as compared with the 663,091 persons counted in the Sixteenth Census of 1940. This report states that the national average increase was about 11 percent.

Since 1939, the District of Columbia Department of Highways has been engaged in making surveys and special studies designed to produce information which would shed light on the patterns of population distribution, government and business activities, and traffic movements. Beginning with limited studies for particular sections or facilities, these investigations have evolved into the highly organized, comprehensive home-interview type of origin-destination survey which yields factual data on all phases of the transportation problem in metropolitan centers. Our planning section, in cooperation with the States of Virginia and Maryland and the Bureau of Public Roads, has just completed one of these extensive surveys.

From the District's point of view, there appears to be a large disproportion between the investment in local highway facilities and the use made of these facilities by residents of the District. For example, it was determined during the Washington Metropolitan Area Transportation Study that suburban traffic, originating in the towns and cities within the orbit of the Nation's Capital, had increased to such a degree that on some of the connecting highways into Maryland and on the bridges over the Potomac linking Virginia with the District, the ratio of out-of-District vehicles had reached high proportions.

The fact that 59.7 percent of all traffic crossing District boundaries

DUPONT CIRCLE Grade Separation is one of several projects undertaken by District of Columbia to increase efficiency of present highway system. Underpass, costing about $3,800,000, and scheduled for completion next March, will carry Connecticut Avenue traffic under Massachusetts Avenue, eliminating former 10-point traffic circle which averaged 52,000 vehicles per 24-hour weekday.

consists of Maryland and Virginia vehicles from nearby communities is one of the controlling factors in the design of our highway facilities. This fact and other available statistics indicate that although the population gains in contiguous civil divisions are much higher than those experienced by the District, reaching in some cases as high as 50 percent over the 1940 level, Washington still remains the focal point for the metropolitan area. The decentralization policy of the federal government has not had any appreciable effect in reducing the traffic pressures on the District's street system. These facts indicate that the Washington Metropolitan Area to all intents and purposes is one community and that the design of highway facilities within that community must be predicated upon this thought, regardless of civil division boundaries.

Bridges Constitute Serious Problem

Since before the war, the Department of Highways has been planning and constructing at great cost a network of major arterials to provide rapid and safe communication between outlying residential areas and the central business and government districts. In several cases, these important collector and distributor streets were joined at the District line by roadways of similar design which led into adjoining areas. However, the Potomac River constitutes a barrier between the District and northern Virginia which, because of the river's location within the geographical limits of the District of Columbia, places the whole burden of providing crossing facilities upon the District.

This fact is mentioned not because it is believed that Virginia should bear a greater portion of the burden, but to indicate the extent and magnitude of the District's problem. Arlington County is fast becoming a city in its own right, and the entire burden of connecting that great community and our own, with adequate and sufficient river crossings, will fall upon the District of Columbia. This task alone is a tremendous one for a community the size of the District.

We have consistently worked to increase the efficiency of the District's highway system in the face of mounting volumes which have overtaxed certain of our facilities, notably circles and multiple intersections on the fringe of the downtown area, and bridges over the Anacostia and Potomac Rivers. Dupont Circle, Whitehurst Freeway, the east structure of the twin crossing over the Potomac River on U.S. Route 1, another crossing of the Anacostia River at South Capitol Street—these are the more spectacular projects put under construction since the end of the war. They are all designed to expedite heavy, twice-a-day traffic movements into the retail business and government districts over the two rivers and to and from the thickly populated communities within the Washington Metropolitan Area.

To this end on May 13, 1948, the District of Columbia and the State Road Commissions of Maryland and Virginia executed the first of two agreements which I believe to be milestones in the development of an adequate system of highways for the Washington Metropolitan Area. In the agreement referred to, each of the three parties undertook to participate in and to share the cost of a comprehensive origin-and-destination survey of persons traveling within or through the area.

This survey has been completed and the original agreement has been implemented by the execution of a second contract under which the District of Columbia and her neighboring states will again participate in and share the cost of a project for the common good of all. This second contract provides for the analysis of the data secured during the survey and the preparation of a joint report expressed in terms of highway networks and their estimated cost to properly serve the area.

To the credit of all three parties it can be said that their own single

NEW SOUTH CAPITOL STREET BRIDGE over Anacostia River serves traffic from densely populated southeast Washington and neighboring Maryland. Besides this $5,400,000 structure, here seen with swing span open, additional crossings of Anacostia River are now needed.

interests were subordinated to the common interest of the entire Metropolitan Area when they contracted to place this important work in a seven-member committee on which were represented groups other than the highway departments of the contracting parties. The committee which will make this study and formulate recommendations is composed of members representing the District of Columbia, Maryland, Virginia, the Bureau of Public Roads, the Department of the Army, the National Capital Park and Planning Commission, and combined transit interests.

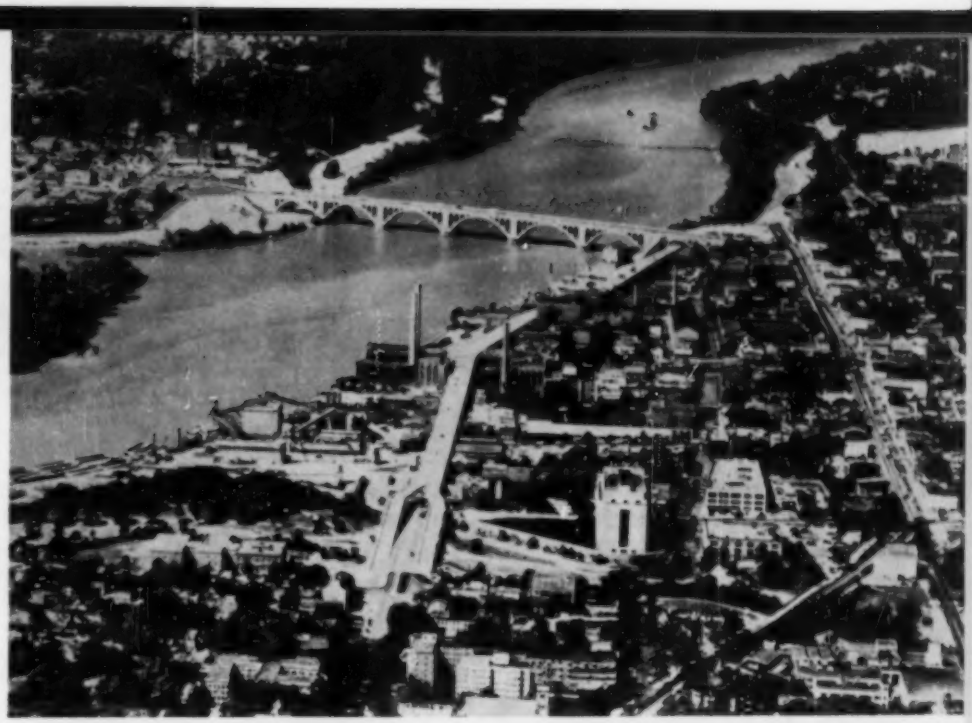
Who Can Pay the Bill?

The construction of the highways which will undoubtedly be recommended will require enormous sums of money and this brings us to the crux of the problem. Who will pay for them? Is this region sufficiently wealthy to finance the construction of highways necessary to serve the Nation's Capital and meet the requirements of the Department of the Army also? Can the work be accomplished when needed to meet the requirements of this rapidly expanding area? In the answers to these questions lies the problem as seen by the District of Columbia Department of Highways.

The boundaries of the District of Columbia are limited by the Constitution. Its total area is 69.25 square miles, of which 9.25 are water. Of the remainder, 51.5 percent is tax-free land. This is not an industrial region and land use is rigidly restricted both as to occupancy and height. All of this is fine and makes a most beautiful city. However, those very factors which contribute to making our Nation's Capital the most beautiful city in the world should not at the same time fix upon the local taxpayers an inequitable burden for financing highway construction.

The District of Columbia is at present behind in its schedule of highway construction. The last ten years have seen a phenomenal growth of the city in an era when it is necessary to plan and construct arterials of an expressway type to move traffic around, through or under congested areas. Any arterial highway or bridge within the District of Columbia must be designed to accommodate the traffic of the entire Metropolitan Area, not just that of the District of Columbia.

Where do these thoughts lead us? To this. This is the Nation's Capital. Its land use, planning and growth have been predicated upon that fact. The city's industry might be called the federal government. Unlike other industry, this industry is not a revenue producer. On the contrary, a balance sheet would show that it costs the taxpayers of the District many thousands of dollars annually. The ebb and flow of great volumes of traffic from Virginia and Maryland are on federal government business. The city is a federal city and the problem is a federal problem. The taxpayers who reside in the area cannot bear it alone. It is evident that federal assistance for the construction of highways, to a greater extent than now provided by law, is not only just but necessary.



FOUR-LANE ELEVATED APPROACH to Francis Scott Key Memorial Bridge over Potomac carries estimated traffic of 30,000 vehicles daily, relieving congestion in historic Georgetown section. Half-mile-long approach (center foreground of aerial view), named Whitehurst Freeway, and recently completed at cost of about $3\frac{1}{2}$ million, is first section of proposed multi-million-dollar crosstown trunk route to tie in with Washington-Baltimore Freeway now under construction.

WISCONSIN AVENUE in Bethesda, Md., is widened to relieve congestion in Washington, D. C., suburban area. Construction of divided highway 0.65 miles long costs $565,412.

POTOMAC RIVER CROSSING on U. S. Route 1 replaces obsolete through-truss bridge built in 1904. Estimated cost is $5,800,000, and completion is scheduled for early in 1950. Twin span in nearby location is proposed.

...THE READERS Write

Francis Turbines Being Built for 1,410-Ft Head

TO THE EDITOR: As a member appointed from the Norwegian Society of Civil Engineers, and sponsored by the American Scandinavian Foundation for further study in the United States, I read with interest the article on "Trends in Hydroelectric Practice," by Merrill and Salzman in the June issue. In connection with the statement that "reaction-type turbines are now being considered for heads up to 1,100 ft," it may be of interest that Francis-type turbines are now operating at heads up to 1,335 ft at the Hol Power Plant, Norway, which I was in charge of designing two years ago.

This plant, about halfway between Oslo and Bergen, is owned and operated by the city of Oslo. The demand is mainly for domestic power, showing high peaks during the winter because of the many modern houses heated by electricity.

It is planned to install four generators with identical characteristics to develop a total output of 180,000 kw. The two units now installed utilize a head of 1,335 ft from Lake Varaldset in the Vaatna River but the two remaining units will utilize varying heads between 1,168 and 1,253 ft from the project's largest reservoir, Lake Strandevann, of 500,000 acre-ft capacity. Several thin-arch and buttress-type dams and unwatering tunnels give the project a total reservoir storage of 700,000 acre-ft, which is necessary to meet winter peak demands. The two Vaatna penstocks are 2,800 ft long and the two Strandevann penstocks will be 2,600 ft long.

HOL POWER PLANT near Oslo, Norway, contains Francis-type turbines designed to operate at speed of 500 rpm and net head of 1,270 ft. Construction view shows 2,800-ft-long penstocks and part of powerhouse at right.

The four Francis-type turbines have a capacity of 62,500 metric hp each. The Vaatna turbines, the first of which began operation on January 14, 1949, were installed with vertical axis and were designed for a net head of 1,270 ft. To my knowledge Francis turbines have never before been used for so high a head. Previously for such heads Pelton turbines were used; they have a lower efficiency and a lower rotation speed, necessitating larger and more expensive turbines, generators, and equipment. Maximum efficiency of the Francis turbines at Hol is estimated to exceed 94.5 percent. Francis turbines utilize the entire head down to tailwater, and, it is considered, will show at least 3 percent higher efficiency than Pelton turbines.

Another appreciable advantage is the low runaway speed of the Francis turbines, 60 to 65 per cent increase, as compared with more than 90 percent increase for a Pelton wheel. Finally, the floor space required is substantially smaller. On the other hand, Francis turbines are not particularly well suited to operate at small loads and are more easily affected by sand and other particles contained in the water.

To avoid cavitation, the Hol turbines are installed below the lowest tailwater elevation. Because of unique design and expert craftsmanship of Kvaerner, Ltd., Oslo, the turbine manufacturers, and a special stainless steel developed by Stroemmens Verksted, Ltd., of Oslo, for the vulnerable parts of guide cases and runners, no serious cavitation is anticipated and none was evident during the first semi-annual inspection. For the Vinstra Powerhouse of another Norwegian project, the same manufacturers have under construction some Francis-type turbines designed for a gross head (from penstock intake to tailwater) of 1,410 ft.

The total annual energy available from the Hol plant, delivered on the low side of the transformer station in Oslo (at 30 kv), is about 700,000,000 kwhr, of which 80 percent can be produced during the winter. The total project cost, including the 116-mile transmission line to Oslo and the transformer station outside Oslo, will be about 150,000,000 kroner, or $19,000,000.

CHR. D. ZERNICHOW
Civil Engineer N.T.H., The Norwegian Institute of Technology
Oslo, Norway

Engineers on Broome County Airport Named

TO THE EDITOR: My attention has been called to omission of credits for the engineering of the Broome County Airport, in my article on airport costs in the September issue.

The plans for clearing, grading, and drainage for the Broome County Airport were made by William H. McFarland, at that time senior engineer for the Broome County Planning Board, and Edward H. Prentice, M. ASCE, consulting engineer, and a member of the Planning Board. Mr. McFarland tells me that the idea of using grass instead of pavement on the third cross runway was originated by him and Mr. Prentice. Seelye, Stevenson & Value had the responsibility for the refinement of these designs and the supervision of construction, as well as the design and supervision of the pavements and building. The latter firm found the basic plans excellent.

A large amount of credit for the basic plans of all these airports should be given to the C.A.A. organization under Reginald J. Sutherland, Assoc. M. ASCE, district airport engineer; William E. Cullian, Jr., chief, Airports Division, Region 1; and to C. B. Friday, acting director, Bureau of Aviation, Department of Commerce.

ELWYN E. SEELYE, M. ASCE
Seelye, Stevenson & Value
New York, N.Y.

SOCIETY NEWS

Merry Christmas and a Successful New Year

Truman and Other Notables Address ASCE Fall Meeting

AIDING THE UNDEVELOPED areas of the world would raise the standard of living in this country and ensure universal peace and prosperity, President Truman told engineers assembled in Washington, D.C., for the opening session of the Society's Fall Meeting on Wednesday morning, November 2. In the first address ever delivered at an ASCE meeting by a President of the United States, Mr. Truman explained his Point 4 Program and stated that if this country could raise the standard of living elsewhere just 2 percent, "our factories and our businesses never could catch up with the demand that would be on them."

Stating that the "contributions made by engineers must be a source of great satisfaction to the profession," the President emphasized the continuing importance of technical know-how in developing the untapped resources of South America, Asia, and Africa. If these resources could be made available to the peoples of the world, he declared, "then no one would have any idea of carrying on a destructive war for the purpose of obtaining something that didn't belong to them." Commenting that the Point 4 Program was conceived "for the benefit of the world and not for its exploitation," he said, "My ambition is to show that an ideology backed by a moral code can be best for the people of the world."

The important place that the engineering profession occupies in civic planning was also stressed by Mr. Truman, who pointed out that the development of the country is the result of vision and planning. Even so, he said, with the possible exception of Salt Lake City, there isn't a city in the United States that was properly planned at the outset to meet modern traffic demands. Urging the group to make "great plans that can be expanded," he said, "You can't have your sights too high."

The President then reiterated the importance of engineers in all phases of planning, and said that nearly every federal activity, except legal and diplomatic affairs, requires engineering skill and knowledge. He added, "If I have my way, the Department of State will have some engineers before we get through."

Guests Welcomed to Washington

Added color was given the Wednesday morning ceremonies by the presence of the Marine Corps Band, uniformed in scarlet and gold, which played several selections, including the traditional "Hail to the Chief" as the President mounted the platform. Mr. Truman was introduced by Maj. Gen. Philip B. Fleming, chairman of the U.S. Maritime Commission.

Other Wednesday morning speakers were Byron Bird, president of the host Section, and Brig. Gen. Gordon R. Young, engineer commissioner for the District of

PRESIDENT TRUMAN ADDRESSES OPENING SESSION OF ASCE FALL MEETING IN WASHINGTON. With him on dais are, left to right, ASCE Vice-Presidents Henry J. Sherman and Carlton Proctor; President-elect Ernest E. Howard; Byron Bird, president of District of Columbia Section; President Franklin Thomas; Maj. Gen. Philip B. Fleming (behind the President), who introduced Mr. Truman; ASCE Past-President E. M. Hastings (barely visible behind reading desk); ASCE Past-President R. E. Dougherty; Brig. Gen. Gordon R. Young, who welcomed group to District of Columbia; ASCE Vice-Presidents Robert B. Brooks and (barely visible) John W. Cunningham; Director Roy W. Crum; Executive Secretary William N. Carey; and A. G. Fiedler, chairman of Excursions Committee.

AT HEAD TABLE AT STUDENT DINNER, culminating feature of two-day Student Chapter Conference, are (left in left-hand photo) Finley Laverty, chairman of Society's Committee on Student Chapters; President Franklin Thomas; and Theodore M. Schad, Jun. ASCE, who was in charge of arrangements for Conference. Three members of host Section compare notes in right-hand photo. Shown in usual order are Francis J. Hanrahan and Clifford A. Betts, vice-chairman and chairman of Entertainment Committee, and Byron Bird, president of District of Columbia Section.

Columbia, who welcomed the engineers to Washington and the District of Columbia. Both stressed the physical changes and improvements made in the city in the 21 years since the Society last met in Washington, and stated that these developments dramatically attest the technical accomplishments of engineers and scientists. In responding for the Society, President Franklin Thomas called the spirit pervading the Capital "stimulating and inspiring, not only because of the history and traditions of the city, but because of the new international aspect of Washington in world affairs."

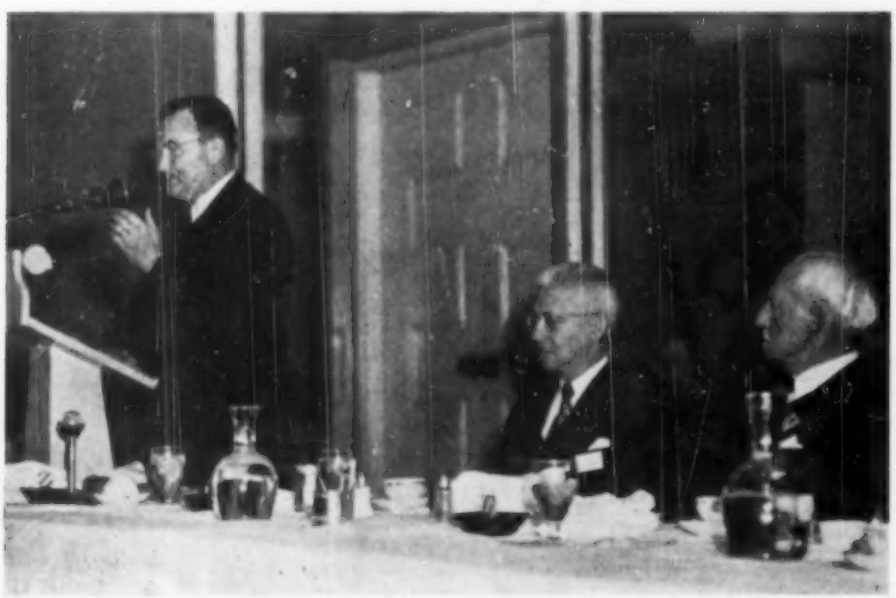
Senator Malone Talks on Foreign Aid

The Hon. George W. Malone, U.S. Senator from Nevada and only member of ASCE in the Senate, was the Wednesday luncheon speaker. In a talk on "The Engineer Looks at Foreign Affairs," Mr. Malone urged engineers to run for office and to take an interest in the many problems, economic and political, that face the country today. He deplored the devaluation of the dollar, advised care in financing aid to foreign countries, urged abrogation of the Reciprocal Trade Program, and advocated that the United States look to South America and the Orient for its trade future. In his opinion, "emphasis should be on the integrity of private investment." Senator Malone, in conclusion, strongly advised the profession to be ready with planned projects—in flood control, public roads, rivers and harbors, reclamation, and other fields—for the day when they will be needed.

Engineer-Contractor Cooperation Expanded

The vital role of the construction industry in national defense was stressed by Dwight W. Winkelman, president of the D. W. Winkelman Co., Syracuse, N.Y., and immediate past-president of the Associated General Contractors of America, in a paper presented at the Wednesday afternoon general session. "Should an attempt be made to destroy our factories, our bridges, our water systems, and other facilities essential to both production and life," he said, "there would be only one source to repair the damage. That would be the construction industry."

Mr. Winkelman noted that the importance of construction to national defense has been one of the subjects of primary concern to the Joint Cooperative Committee of ASCE and AGC, which recently completed its first year. Other mutual concerns include the education of engineers and the improvement and modernization of contract documents and specifications. Since the Joint Cooperative Committee was organized, he concluded, "a pattern has been established for cooperative action by civil engineers and general contractors that can do much to improve the industry's service to the public."



SENATOR GEORGE W. MALONE of Nevada, only ASCE member in U.S. Senate, holds spotlight at Wednesday luncheon meeting, where he was featured speaker. With him are (left) Bryon Bird and ASCE Vice-President Henry J. Sherman.

Thursday Devoted to Technical Sessions

The Technical Program Committee, under the general chairmanship of Gail A. Hathaway, had arranged sessions of ten Technical Divisions, which went off as scheduled on Thursday. Many of the papers presented appeared in full or in abstract form in the November issue. Articles based on other papers are printed elsewhere in this number.

To publicize the work of the profession,

COOPERATIVE ACTIVITIES OF AGC—ASCE JOINT COMMITTEE are discussed at construction luncheon in Washington. Left to right are A. N. Carter, Walter Couse, representing AGC; Carl E. Beam and Society Director Kirby Smith, representing ASCE; Dwight W. Winkelman and James D. Marshall, AGC; and Gail D. Hathaway, ASCE. Right-hand photo shows two Wallaces—Donald S. (left) and J. N. (right)—in conversation at Local Section Conference. Donald S. is president of Virginia Section, and J. N., of West Virginia Section. They are not related.

the Technical Divisions had arranged for the display of unusually striking exhibits on the Statler's mezzanine floor, which was largely given over to the meeting. Displays of the Civil Engineer Corps of the Navy, the Bureau of Reclamation, the Corps of Engineers, the Bureau of Public Roads, and other agencies also attracted wide attention. Of much interest to the general public were models of portable bridges, prepared by the Bureau of Public Roads, and a huge model of the city of Washington, with proposed construction projects indicated, that had been set up in the lobby. The latter exhibit was the work of the National Capital Park and Planning Commission.

Thursday Social Sessions

Discussing "The World Today" at the Thursday luncheon meeting, Dean Elmer Kayser, of George Washington University, decried the preoccupation of engineering and science with physical matter. "In spite of all its glories, your great profession has not yet approached the real peak of its eminence," he told the group. "If you will but attend to the true art as well as the true science of your profession, the way will be open. The true art of the engineer has to do with men. He builds with them and by them and for them."

Thursday evening Maj. Gen. Douglas L. Weart, commanding general of the Army engineer post at Fort Belvoir, was host to the engineers at an informal stag oyster feed and smoker at Fort Belvoir. Entertainment included a male quartette, specially staged boxing matches, a magician's show, and music by a navy band. During the evening ASCE President Franklin Thomas presented a special Board of Direction certificate to Archie N. Carter commending him for his untiring services as general chairman of the Fall Meeting committees. Officers of the Civil Engineer Corps of the Navy and the Corps of Engineers of the Army assisted generously in the festivities.

Ladies Entertained Royally

The women of the party attended a special dinner on Thursday evening, which was addressed by Mrs. Thomas Burke, president of the Pan-American Liaison Committee of Women's Organizations, and chairman of the Latin American People's Mandate Committee. In a talk on our "Latin American Neighbors to the South," Mrs. Burke termed continental amity very important. Stating that Latin Americans look to the United States for guidance and inspiration, Mrs. Burke stressed the fact that good will must be reciprocal and urged more travel to South America and other efforts to strengthen ties between the Northern and Southern Hemispheres.

Entertainment for the women also included a visit to the National Art Gallery and a motor trip around Hains Point, where some of the famous Japanese cherry trees bloomed unseasonably for the visitors. Those arriving in Washington early in the week had a special treat in tea at Blair House. In Mrs. Truman's absence from the city, the ladies were received by Mrs. Vinson, wife of the Chief Justice, who invited them to tour the first

ASCE DIRECTOR ROY W. CRUM (left in left-hand photo) chats with two Technical Division chairmen—Elmer K. Timby, chairman, Executive Committee, Construction Division (center), and Craig P. Hazelet, chairman, Executive Committee, Structural Division—at Fall Meeting. Group on platform at Thursday luncheon is shown in right-hand photo. In usual order are Dean Elmer Kayser, of George Washington University, featured speaker; Byron Bird, president of D.C. Section; ASCE President-Elect Ernest E. Howard; and President Thomas.

floor of the beautiful century-old house. The Women's Activities Committee was headed by Mrs. Gail A. Hathaway.

Record Student Chapter Conference

The total meeting registration of almost 1,600 included 640 students in attendance at a Student Chapter Conference on Tuesday. Representing 34 Chapters, the group constituted the largest student assembly in the history of the Society. A dinner in the South Interior Building on Tuesday evening, sponsored by the District of Columbia Section, climaxed a two-day program of inspection trips, talks, and vocational conferences.

The featured speaker at the dinner meeting was Rear Admiral John J. Manning, chief of the Bureau of Yards and Docks, who urged the student group to "go beyond the narrow horizons of your technical training to the broader horizon of usefulness and influence in your communities." Counseling his hearers to seek opportunities to develop professionally in their early careers rather than mere financial security, Admiral Manning advocated training in writing and public speaking as highly important preparation for a full and useful life. "Far from being contemptuous of such powers as we engineers do not possess, we should seek to develop them for ourselves," he asserted.

The highway trip proved most popular with the students, and the group of 284 in attendance was broken into two parts for ease in handling. This tour, which included inspection of the Bureau of Public Roads Research Laboratories at the Arlington airport and the modern highway and bridge facilities recently completed in the Washington area, was made possible by the Bureau of Public Roads. Also popular was the railroad trip, which took in inspection of the Potomac Freight Classification Yards and diesel shop and testing laboratories of the Southern Railway Co., at Alexandria.

Much of the emphasis of the meeting was on vocational discussion, and representatives of the Virginia Highway Department and the Southern and other railways had suites at the Statler to interview students concerning employment. The Associated General Contractors' program of student summer employment was outlined at the student dinner meeting by Archie Carter, of the AGC staff.

Local Section Conference

Highly successful also was the two-day Local Section Conference on Monday and Tuesday, which drew delegates from 26 Sections including Panama and Venezuela. The conference is reported elsewhere in this issue.

Board of Direction Actions at Washington, D.C. Noted by Secretary

WITH BUT ONE absentee, the Board of Direction met at the Statler Hotel in Washington, October 31 and November 1. Presidential Nominee, Ernest E. Howard, was present by invitation. Actions of the Board are noted below.

Separate Papers to Replace "Proceedings"

Change in the form of PROCEEDINGS, during the fiscal year 1950, to publication and distribution of individual papers as separates was approved to be effective as early in the year 1950 as practicable. The Publication Committee was authorized to prepare a Manual governing the practices of presentation and publication of papers and discussions, and to put the recommended plan into effect.

Balanced Budget Adopted

A balanced budget in the amount of $736,682 was adopted for the next fiscal year. As the result of economies the Society's financial position is improved. Continued observance of rigid economies will build up a reserve against future reduction in essential services.

Chicago Chosen for Centennial Celebration

A week of celebration in Chicago in September 1952 was set by the Board for a "Century of Civil Engineering—Commemorating the Centennial of the American Society of Civil Engineers." The four other constituent societies of Engineers Joint Council and the American Institute of Architects are to be invited to participate and to hold meetings in Chicago during or close to the period of the celebration.

Republic of Mexico Gets Local Section

Upon approval by national engineering societies in the Republic of Mexico, and acting on recommendation of the Committee on Local Sections, a petition by members in Mexico for the formation of a Local Section to cover the entire Republic was approved by the Board.

ECPD Reports on Uniform Membership Grades

Final action on the report on uniform membership grades developed by ECPD was received by the Board and referred to the ASCE Committee on Membership Grades for study and report at the January 1950 meeting of the Board. The ECPD report recommends that professional engineering societies adopt three essential grades of membership: namely, Member, Associate Member, and Student Member.

Improvement in Technical Activities Studied

The details of the Technical Procedure Committee's recommendations for improving the technical activities of ASCE as developed at the Chicago conference on August 19–20 were considered by the Board. Because of the complexity and importance of the proposals in the report, the Board deferred action on the recommendations to its January 1950 meeting. Steps already being taken to tie Local Sections closer to the Technical Divisions are described elsewhere in these pages.

Society's 57th St. Property Leased to Shattuck Co.

A new lease on the Society's property at 220 West 57th Street, New York, to Shattuck Co. was approved by the Board for a five-year period. The net income will be about $20,000 per year less to the Society than the previous lease to the same company.

ASCE Will Participate in London Conference

Conclusions as to international cooperation among engineering societies as developed at the London Conference in September and further participation by ASCE in the Conference were approved. The type of collaboration envisaged is described in the aims and objectives of the Conference, outlined in CIVIL ENGINEERING for October, p. 51.

New Year Book Available in January

The Board received the Secretary's report that the 1950 Year Book, containing membership list as of September 30, 1949, will be mailed to members in January 1950.

Code of Ethics Amended

Competitive price bidding by professional engineers was officially condemned by the Board. A paragraph was added to the Society's Code of Ethics, stating that it will be considered unethical and inconsistent with honorable and dignified bearing for any member of the Society "To participate in competitive bidding on a price basis against his colleagues to secure a professional engagement."

University of Puerto Rico Gets Student Chapter

Petition for the formation of an ASCE Student Chapter at the University of Puerto Rico was approved.

National Water Resources Policy Needed

Continued interest by the Board in a proposed development of a National Water Resources Policy was indicated in the receipt of a report by the Society's committee and the continuation of the committee for the purpose of further assistance to the EJC Committee on National Water Resources Policy. Creation of a federal commission is visualized.

Five Honorary Members Elected

In accordance with the provisions of the Constitution, the following members were elected to Honorary Membership: Charles B. Breed, William P. Creager, Wilford W. De Berard, Theodor von Kármán, and Wilbur M. Wilson.

Technical Division Executive Committee Appointments

Following recommendations by the Division Activities Committee, five-year appointments terminating in 1955 were made to the Executive Committees of Technical Divisions shown below:

Air Transport	Walter Johannessen
City Planning	H. W. Alexander
Construction	Charles H. Tompkins
Engineering Economics	Charles M. Noble
Highway	De Witt C. Greer
Hydraulics	Jacob E. Warnock
Irrigation	W. E. Blomgren
Power	Byron O. McCoy
Sanitary Engineering	Francis S. Friel
Structural	R. N. Bergendoff
Soil Mechanics & Foundations	Hibbert M. Hill
Surveying & Mapping	Henry B. Aikin
Waterways	Thomas M. Robins

Future Meetings Set

Subject to assurance that hotel accommodations will be obtained, the Board approved three meetings of the Society during 1951 as follows:

February 1951	Houston, Tex.
June 1951	Louisville, Ky.
October 1951	New York, N.Y

Biographies of New ASCE Nominees Summarized

ALBERT HAERTLEIN

ALBERT HAERTLEIN IS a specialist in the field of engineering education. Though a native of Illinois, his childhood was spent in St. Louis, Mo., where he prepared for college in the public schools. He received the degree of bachelor of arts from Harvard College in 1916 and the degree of bachelor of science in civil engineering from Harvard University

ALBERT HAERTLEIN
Nominee for Vice-President, Zone I

and from the Massachusetts Institute of Technology in 1918. He also holds the honorary degree of doctor of engineering, which was awarded him by Northeastern University in June 1949.

During the first World War Mr. Haertlein served with the American Expeditionary Forces as lieutenant in the Corps of Engineers. Following release from the Army in 1919, he became an instructor at the Harvard Engineering School. There he assisted the late George Fillmore Swain, Past-President and Honorary Member of the Society, for a period of four years. Between 1923 and 1928 he was an engineer for Dwight P. Robinson & Co., of New York City.

In 1928 he was called back to Harvard University as a lecturer in civil engineering, and was appointed associate professor of civil engineering in 1929. Since 1940 he has been Gordon McKay Professor of Civil Engineering.

Becoming a Junior in the Society in 1920, Associate Member in 1923, and Member in 1930, Professor Haertlein served as Director for District 2 between 1946 and 1949. He was president of the Northeastern Section of the Society in 1937. He was also president of the Boston Society of Civil Engineers in 1941, and president of the Engineering Societies of New England from 1945 to 1947. His present affiliations include the American Academy of Arts and Sciences, the American Concrete Institute, the American Society for Testing Materials, the American Railway Engineering Association, and the American Society for Engineering Education. He has been a member of the Board of Registration of Professional Engineers and Land Surveyors since 1942 when the law became effective in the Commonwealth of Massachusetts.

FRED C. SCOBEY

SENIOR IRRIGATION ENGINEER in the U. S. Department of Agriculture at Berkeley, Calif., Fred C. Scobey has devoted much of his career to research in the hydraulics of canals and pipes for the conveyance of water.

Mr. Scobey graduated from Stanford University "with distinction," and since has been awarded honorary membership in Chi Epsilon, Tau Beta Pi, and Sigma Xi. After early work on railroad location, he gravitated toward irrigation and drainage hydraulics. As state engineer of Mississippi under Governor Vardaman, he mapped and planned drainage systems for the State Farms in Mississippi Returning West, he operated the water works and reservoir system of the Raton Water Co. and Raton Ice Co. in New Mexico.

FRED C. SCOBEY
Nominee for Vice-President, Zone IV

In 1910, after two years as consultant to the great Imperial Valley Canal Companies, Mr. Scobey accepted a position as irrigation engineer in the U. S. Department of Agriculture. Since 1914 he has been a research engineer in various bureaus of the Department. His studies of canals and pipes have resulted in U. S. Department of Agriculture bulletins on Flow of Water in Irrigation Channels; Flow of Water in Wood Stave Pipes; Flow of Water in Concrete Pipes; Flow of Water in Riveted Steel and Analogous Pipes; Flow of Water in Flumes; Flow of Water in Irrigation and Similar Canals.

Results of a survey of the present and potential irrigated lands in the Western States, made by Mr. Scobey in 1934, were published by the National Resources Committee in 1936. From 1936 to 1942 Mr. Scobey was associated with

Harlowe Stafford, M. ASCE, in the coordination and assemblage of data that resulted in publication of the National Resources Committee on the Rio Grande Joint Investigation and the Pecos River Joint Investigation. Both of these comprehensive studies resulted in interstate compacts under which the Rio Grande and the Pecos rivers are now administered.

On the Rio Grande investigation, Mr. Scobey developed a method of mapping large areas for the determination of acreage in many classifications. This method used aerial views to locate fields of specific crop or other class. The various local areas of one class were then cut out of paper or film photographs and weighed in mass against the weights of a 1,000-acre template-cut block from the same field sheet. This system has been used in the Soil Conservation Service to determine massed soil types throughout the United States, and by Western states in mapping particular river basins.

Mr. Scobey has served as consultant, either directly or through consulting engineers, to the War Department and the Bureau of Reclamation, to Tulsa, Denver, and Eastern cities, in the matter of improving their quantities of water supply and the conveyance of that water increase from source to city.

Becoming an Associate Member of ASCE in 1913 and a full Member in 1921, Mr. Scobey has taken an active part in Society work. He was secretary and then chairman of the Irrigation Division, on the Committee of Irrigation Hydraulics throughout its ten-year life, and later on the Research Committee. In 1938, on instruction from the Board of Direction, he organized the Hydraulics Division and served as its chairman until elected a Board Director for the 1942–1945 war years. Following his Board term, Mr. Scobey was appointed to the Committee on Local Sections, serving as chairman during the current year of 1949. A charter member of the Sacramento Section, he served on its first Board of Directors. He has also been an officer and committee chairman of the San Francisco Section. Mr. Scobey is a member of Commonwealth Club of Berkeley and the Engineers' Club of San Francisco.

OTTO HOLDEN

LONG AND PROMINENTLY identified with the Hydro-Electric Power Commission of Ontario, Otto Holden is now assistant general manager—engineering. He was born in Toronto, attended the public school and collegiate institute there, and graduated from the University of Toronto with the degree of B.A.Sc., later receiving the postgraduate degree of C.E. and in 1944 the honorary degree of D.Eng.

Mr. Holden joined the staff of the Commission as a draftsman in 1913 and, thereafter, filled various posts in the Hydraulic Department, becoming chief hydraulic engineer in 1937. He was appointed to his present position in 1947. In 1918 he was placed in charge of the design of hydraulic plants. At that time he was particularly engaged on the Nipigon River plant at Cameron Falls, and later took charge of the design of the Queenston Plant on the Niagara River, as well as numerous other plants in various parts of the Province.

Becoming deputy head of the Hydraulic Department of the Commission in 1924, he supervised the design and construction of power plants, storage works, and hydraulic structures. The first complete development of an interprovincial power site in the Ottawa River was commenced in 1929 at Chats Falls, about 34 miles from the City of Ottawa, and the task of supervising the design and construction of the whole plant was assigned to Dr. Holden.

As chief hydraulic engineer of the Commission (1937–1947), Dr. Holden was responsible for the design and construction of all hydraulic power plants, storage works, and other hydraulic structures and the engineering problems in connection with their operation. Specific developments on which he was engaged while holding the appointment included

OTTO HOLDEN
Nominee for Director, District 3

power developments on the Muskoka River at Big Eddy, on the Madawaska River at Barrett Chute, and at De Cew Falls near St. Catharines. Under his direction, other works were also built at various points. These included the storage dam at Bark Lake on the Madawaska River, and the diversion of the waters of the Ogoki River into the Great Lakes from their natural course into Hudson Bay.

Dr. Holden was a member of the International Committee charged with the design and construction of remedial works in the Niagara River. In his present position, he administers the activities of the Engineering, Construction, Supply and Research Divisions of the Commission and cooperates in the management of Commission affairs.

A member of ASCE since 1940, Dr. Holden is a member, and former councillor, of the Engineering Institute of Canada, past-president of the Engineering Alumni Association of the University of Toronto, and past-president of the Royal Canadian Institute. He has contributed a number of papers to technical journals.

FRANK L. WEAVER

WELL KNOWN IN the field of river basin and hydroelectric power development, Frank L. Weaver is chief of the Division of River Basins, Bureau of Power, Federal Power Commission, Washington, D. C., with which he has been connected since 1934.

Graduating in civil engineering from the University of Michigan in 1913, Mr. Weaver spent most of his professional life in Michigan until his return to his native city of Washington. His early career included summer work with the Coast and Geodetic Survey and the District of Columbia Surveyor's Office; one year as instructor in civil engineering at the University of Oklahoma and two years at Johns Hopkins University; work on hydroelectric power development for the late Gardner S. Williams in Ann Arbor; and work with Clarence W. Hubbell, consulting engineer to the City of Detroit, on investigation and report of that city's sewage problem. The latter project was undertaken jointly with the International Joint Commission of the United States and Canada.

Mr. Weaver left John Hopkins University in May 1917 to enter the armed forces, serving as captain of Engineers in the 305th Engineers, 80th Division, and participating in the Somme, St. Mihiel, and Meuse-Argonne offensives.

After his discharge in June 1919, Mr. Weaver joined the late Mortimer E. Cooley and the late Henry E. Riggs on appraisal of the Detroit United Railways. Upon completion of that work he rejoined Mr. Hubbell and was engaged in general consulting practice in Detroit for the next 15 years. During this entire period he was intimately connected with the wide variety of engineering problems associated with the rapid growth of Detroit and neighboring communities such as Dearborn and Wyandotte in Wayne and adjoining counties, includ-

ing water supply, drainage, sewerage and sewage treatment, floods, highways, and separation of grades. The Dearborn projects presented problems involved in the development of the Ford Rouge Plant, including utilities and access highways and grade separations needed for it. As city engineer of Wyandotte, during this period, he was also directly responsible for that city's program of municipal improvement expansion.

FRANK L. WEAVER
Nominee for Director, District 5

Since returning to Washington in 1934, Mr. Weaver has been associated with the Federal Power Commission—first on the National Rate Survey, then on work involving valuation of licensed hydroelectric projects, and since 1938 on the Commission's work in the development of our rivers. This work, which is carried out primarily in accordance with the provisions of the various Flood Control and River and Harbor Acts, relates principally to the development of power as a part of the river programs. Through this work and his activities on inter-agency committees dealing with such problems, Mr. Weaver is recognized as an authority in the field.

A corporate member of ASCE since 1920, Mr. Weaver is past-president of the District of Columbia Section, which he also served as treasurer, secretary, and vice-president. He is chairman of the Local Qualifications Committee for District 5, and Local Section delegate to the District of Columbia Council of Architectural and Engineering Societies. Other affiliations include the American Geophysical Union, the Washington Society of Engineers, and the Cosmos Club. He is a registered professional engineer in the State of Michigan, and a member of Tau Beta Pi and Sigma Xi.

GORDON H. BUTLER

ALREADY ON THE ASCE Board of Direction, to which he was appointed last spring to fill the unexpired term of Lewis M. Gram, Gordon H. Butler has now been elected to a three-year term as Director from District 7 in his own right. He is president and owner of the Polaris Concrete Products Co., Duluth.

Mr. Butler was born at Scipio, Ind., and educated at Purdue University, from which he received the B.S.C.E. degree in 1913. His early experience included work with the Pennsylvania Railroad, the American Bridge Co., and two years as superintendent of construction for the Stack Construction Co., of Duluth. From 1917 to 1919 he was in 1st Training Camp, made 1st lieutenant and in 1918 was promoted to captain in the Corps of Engineers, serving overseas for a year. At the end of the war, Mr. Butler returned to his former post as superintendent of construction for the Stack Construction Co., where he remained until 1928.

Since the latter date he has been president of the Polaris Concrete Products Co., except for a five-year period in World War II as major, lieutenant colonel, and from 1942 as colonel in the Corps of Engineers. He saw service in both the European and Pacific theaters of war, and was in charge of the construction of a $18,000,000 anhydrous ammonia plant in this country. He retired from the army with the rank of colonel in March 1949.

As head of the Polaris Co., Mr. Butler has supervised the construction of numerous railroad, highway, dock, dam, and other projects throughout the Middle West. These include a 1,600-ft breakwater at Presque Isle, Mich.; the Fond du Lac Highway Bridge for the Minnesota Highway Department; dams for the Northern Wisconsin Power Co., and the Northwest Paper Co.; a 1,500-ft dock bridge rail foundation for the Cleveland Cliffs Dock Co.; a 2,000,000-gal reservoir for the City of Duluth; and schools and industrial buildings.

GORDON H. BUTLER
Nominee for Director, District 7

A corporate member of the Society since 1920, Mr. Butler has been active in the work of the Duluth Section, which he has served as president. He is also a past-president of the Duluth Engineers Club, the Minnesota Federation of Engineering Societies, and the West Duluth Businessmen's Club, and a former director of the Duluth Chamber of Commerce, the Duluth Rotary Club, the Ridgeview Golf Club, and the Duluth Athletic Club. He is a director of the Western National Bank of Duluth. He belongs to the Reserve Officers Association of Duluth, and is currently completing a term as member of the Duluth Airport Board. He is also active in civic and church groups. Mr. Butler is a registered professional engineer in Minnesota.

LOUIS R. HOWSON

A PROMINENT CONSULTANT, Louis R. Howson has spent his entire professional career with the Chicago firm with which his name is associated.

Following Mr. Howson's graduation from the University of Wisconsin in 1908 with the degree of bachelor of science in civil engineering, he was employed by Alvord & Burdick, an old established firm specializing in hydraulic and sanitary engineering. After varied experience in the office on design, investigations, and reports and on the supervision of construction in the field, Mr. Howson was made principal assistant engineer. Later he was admitted to partnership. The firm name was changed to Alvord, Burdick & Howson in 1922.

Mr. Howson's personal experience, like that of his organization, has covered all phases of public water supply, sewerage and sewage treatment, flood relief, and a wide variety of public utility appraisal, a field to which he has given a great deal of attention. He has presented expert testimony before many of the state public utility commissions, the Interstate Commerce Commission, and numerous state and federal courts on matters relating to the valuation of public utilities, and has served on many arbitration boards fixing the value of public utility properties for transfer from private to public ownership. In such cases he has represented the public and private interests in almost equal number and in many cases has been selected as the neutral arbitrator.

He was principal sanitary engineering witness for the states of Wisconsin, Minnesota, Michigan, Ohio, Pennsylvania, and New York in four U.S. Supreme Court hearings, related to Lake Michigan water diversion and sewage treatment for metropolitan Chicago, two of which were before the late Charles Evans Hughes as Special Master.

Mr. Howson is a frequent contributor to the literature of the fields in which he

LOUIS R. HOWSON
Nominee for Director, District 8

specializes through the PROCEEDINGS of the ASCE; the Journal of the American Water Works Association, of which he is past-president; and the Journal of the Western Society of Engineers, of which he is also a past-president, and through various technical publications.

Entering the ASCE as an Associate Member in 1914, Mr. Howson later transferred to Member. He has been active in Local Section affairs, and has served as chairman of the Illinois Section. He is a former member and chairman of the Society's Committee on Fees and, at the present time, is chairman of the Committees on Valuation Procedure and Depreciation. His other professional affiliations include the Western Society of Engineers, the American Society of Mechanical Engineers, the American Institute of Consulting Engineers, and the American Water Works Association, of which he is honorary member.

For many years Mr. Howson has been engineering member of the Illinois State Board of Conservation and Natural Resources. He has also been active in public affairs of his home community, and is currently a member of the Hinsdale Utilities Commission.

G. BROOKS EARNEST
Nominee for Director, District 9

G. BROOKS EARNEST

WELL KNOWN IN the field of engineering education is G. Brooks Earnest, who has extended his career to include many civic and technical society activities.

A two-year intermission between his sophomore and junior years at Case School of Applied Science (now Case Institute of Technology) was spent with the American Steel and Wire Co., the Republic Structural Iron Co., and as research assistant with the late Dr. Dayton C. Miller, prominent physicist. Following Mr. Earnest's graduation from Case in 1927 with a B.S. degree in civil engineering, he worked with the Pennsylvania State Highway Department, the Cleveland Union Terminal Construction Company, the Cleveland Rapid Transit Inc., and the New York Central Railroad.

Returning to Case in 1930 as an instructor in civil engineering, Mr. Earnest obtained his M. S. degree in civil engineering in 1933, became assistant professor in 1935, associate professor in 1942, and professor of engineering surveying in 1948. Since 1937 he has been associate director and (1944) consulting director on the Cleveland Regional Geodetic Survey. He organized the first large-scale city mapping program using photogrammetric procedures.

During World War II, in addition to his teaching duties, Professor Earnest was executive secretary to the President of Case, assisting in developing the Navy V-12 program and as faculty adviser to several student organizations. He has given freely of his time and abilities to civic and allied activities. He was on the Mayor's Committee on City Planning, which recommended the existing City Planning Department setup for Cleveland, and on the Advisory Committee to the Cleveland Transit Board, which made recommendations pertaining to the rapid-transit program now in force. He is a member of the Cleveland Automobile Club Transportation, Transit and Traffic Panel and the Transportation Committee for the Cleveland Heights Chamber of Commerce. He is a member of the Cleveland Museum of Art and active in the affairs of the Cleveland Heights Presbyterian Church.

In addition to the ASCE, Professor Earnest holds membership in the American Congress on Surveying and Mapping, the American Society of Photogrammetry, the American Society of Engineering Education (chairman, Committee on Surveying and Mapping, 1943) the Society of American Military Engineers, the Cleveland Engineering Society, and the American Association of University Professors. He is a registered professional engineer and surveyor in the State of Ohio and a member of the Education Committee of the Ohio Society of Professional Engineers and the Constitution and By-Laws Committee of the Cleveland Society of Professional Engineers. He is a past-president (1946) of the Cleveland Technical Societies Council, and has been chairman of its Freeway Committee and its Public Affairs Committee and a member of the Board of Governors through 1949. He also holds membership in the Regional Association of Cleveland, Tau Beta Pi, Sigma Xi and Pi Delta Epsilon.

Professor Earnest was elected an Associate Member of ASCE in 1935 and Member in 1940. He served as secretary-treasurer of the Cleveland Section from 1938 to 1941, vice-president in 1942, president in 1943, and on its board of direction from 1944–1949. His national ASCE activities include membership on the Executive Committee; the Division of Surveying and Mapping, 1944–1949, chairman 1947, and the Committee on Student Chapters, 1944-1948, chairman 1947.

Professor Earnest is the author of a number of articles, largely on the Cleveland Regional Geodetic Survey control and aerial mapping project, which have appeared in CIVIL ENGINEERING, *Photogrammetic Engineering, Engineering News-Record* and *The American City*. He is co-author of "Specifications for Topographic Surveys," which appeared in *Proceedings* for March 1946.

WALTER J. RYAN

HAVING SERVED IN the Pacific Northwest during most of his professional career, Walter J. Ryan now has an office in Tacoma, Wash. He has just returned from New Zealand, where he was engaged as consultant for the New Zealand Forest Service on matters of logging engineering.

Mr. Ryan was with the Weyerhaeuser Timber Co. from 1914 to 1947, serving as engineer for the subsidiary companies—Snoqualmie Falls Lumber, Cherry Valley Logging, Columbia and Cowlitz Railway—and after 1923 as chief logging engineer at Tacoma. During this period the company has developed nine new logging operations for the harvesting of the timber crop on two million acres of timberlands in Oregon and Washington. Engineering operations have involved making contour maps of the areas, developing camp sites and towns with attendant utilities, and developing transportation systems, including location and construction of railroads and heavy service truck roads.

A native of Nebraska, Mr. Ryan attended Oberlin College (A.B., 1903), Purdue University and Cornell University

WALTER J. RYAN
Nominee for Director, District 12

(C.E., 1906). Upon graduation, he was employed by the Northern Pacific Railway, spending several years on location, maintenance of way and construction, on various parts of the system from North Dakota to Oregon. The major subject in his engineering course was hydraulics, and he took employment on irrigation work when available. He was with the U.S. Reclamation Service in Montana and Wyoming and on private projects in Washington and California. His army experience consisted of a commission as captain and training at the Engineers' School at Camp Humphreys in 1918.

Elected a Junior in the ASCE in 1908, Associate Member in 1910, and Member in 1920, Mr. Ryan is now a Life Member. He helped in the organization of the Tacoma Section, which he served as president in 1933, and has done ASCE committee work. He was chairman for the Society's Annual Convention in Tacoma in 1931. He is a member of the Seattle Engineers Club, and an officer of the Tacoma Engineers Club. Mr. Ryan has taken an active part in the Pacific Logging Congress and served as its president in 1938. This organization is interested in developing the recognition of engineering in the forests and has sponsored courses with the degree of Logging Engineer in the universities.

Especially interested in development of the proper use of timber as a structural material, Mr. Ryan has employed it in the construction of many bridges and structures, and was an early user of modern timber connectors. He has served on the Wooden Bridges Committee of the American Railway Engineering Association and worked with the engineers of the West Coast Lumbermen's Association in developing stress grade lumber specifications. He is an associate of the Society of American Foresters and a member of the Forest Products Research Society and American Society of Photogrammetry.

Long interested in civic affairs, Mr. Ryan has served on committees of the State of Washington and City of Tacoma. In 1948 he was president of the Tacoma Municipal League.

GEORGE W. LAMB

MUCH OF GEORGE W. LAMB'S experience has been in structural design, especially bridges, and his experience in this field has been extended during the past four years, as district engineer of the American Institute of Steel Construction.

Mr. Lamb received a bachelor of science degree in civil engineering from the University of Kansas in 1926. From then until 1929 and for three years prior to his graduation, he was assistant county engineer for Douglas County, Kansas. During this period of increasing

GEORGE W. LAMB
Nominee for Director, District 16

activity in highway construction, his work was in the survey, design, and construction of bridges and highways.

In 1929 Mr. Lamb was employed by the newly formed Kansas Highway Commission as a designer in the bridge department. For the next seven years, he was in charge of the design of many of the major bridges constructed in the state and federal highway systems and in the development and design of unusual and special bridges.

In 1936 and 1937, Mr. Lamb was assistant division engineer on construction for the department. Many of the structures in the $4,500,000 program constructed during this period had previously been designed by him. The program included construction of 17 grade separations, 3 major bridges, 36 miles of concrete pavement, and 80 miles of grading. As bridge engineer in the department from 1937 until 1942, he supervised the design of all the bridges in the state during that period.

In 1942, soon after the beginning of the war, Mr. Lamb was employed by the Missouri Valley Bridge and Iron Co. (Shipbuilding Division) as office engineer and then assistant chief engineer on construction of a shipyard at Evansville, Ind., and the production of 171 Landing Ship Tanks. Work on this project, which cost approximately $300,000,000 and employed 18,000 persons, consisted primarily of administration and coordination of the various departments in the yard and various agencies dealing with the production of ships. In 1944 Mr. Lamb returned to the Kansas Highway Commission as bridge engineer, and since 1945 he has been district engineer for the American Institute of Steel Construction.

Elected an Associate Member of ASCE in 1936 and Member in 1946, Mr. Lamb served as secretary-treasurer of the Kansas Section from 1936 until 1942 when he moved out of the Section. He was president of the Kansas Section in 1946 and on its board of directors until 1948.

Mr. Lamb's published writings have been in the field of structural design and bridge construction, and he has entered into the discussions of these topics in the PROCEEDINGS of ASCE. He is a member and former director of the Kansas Engineering Society, associate member of the American Welding Society, and member of the Metals and Welding Committee of the National Research Council.

ASCE Prizes and Awards Are Announced by Board

ASCE PRIZES AND awards for 1949 were announced by the Board of Direction at the Washington meeting. Presentation to the following recipients will be made at ceremonies held during the Annual Meeting in New York in January. Further details, together with brief biographies of the winners, will appear in the January 1950 issue of CIVIL ENGINEERING.

Norman Medal

GERARD H. MATTHES, Hon. M. ASCE, for Paper 2329," Mississippi River Cut-offs."

J. James R. Croes Medal

F. H. KELLOGG, M. ASCE, for Paper 2356, "Investigation of Drainage Rates Affecting Stability of Earth Dams."

Thomas Fitch Rowland Prize

H. M. WESTERGAARD, M. ASCE, for Paper 2340, "New Formulas for Stresses in Concrete Pavements of Airfields."

James Laurie Prize

G. H. HICKOX, M. ASCE, A. J. PETERKA, Assoc. M. ASCE, and R. A. ELDER, Assoc. M. ASCE, for Paper 2353, "Friction Coefficients in a Large Tunnel."

Arthur M. Wellington Prize

ARTHUR CASAGRANDE, M. ASCE, for Paper 2351, "Classification and Identification of Soils."

Collingwood Prize for Juniors

ALFRED MACHIS, Jun. ASCE, for Paper 2333, "Experimental Observations on Grouting Sands and Gravels."

The J. C. Stevens Award

DONALD E. BLOTCKY, Assoc. M. ASCE, for discussion of Paper 2342, "Development and Hydraulic Design, Saint Anthony Falls Stilling Basin."

Karl Emil Hilgard Prize

VITO A. VANONI, M. ASCE, for Paper 2267, "Transportation of Suspended Sediment by Water."

Leon S. Moisseiff Award

ALEXANDER HRENNIKOFF, Assoc. M. ASCE, for Paper 2334, "Theory of Inelastic Bending with Reference to Limit Design."

James W. Rickey Medal

FRED W. BLAISDELL, Assoc. M. ASCE, for Paper 2342, "Development and Hydraulic Design Saint Anthony Falls, Stilling Basin."

Daniel W. Mead Prize for Juniors and Students

S. L. MCFARLAND, Jun. ASCE, and WILLIAM H. BLAIR, University of California Student Chapter, for papers on "Under what conditions . . . is it ethical for an engineering society . . . to make studies and recommendations, without remuneration, on proposed public projects?"

Board of Direction Revises Society's Interim Fee Report

AT ITS OCTOBER 1949 meeting the Board of Direction revised the Society's "Interim Report: A Method of Estimating Fees for Professional Civil Engineering Services," which was adopted by the Board last July and published in the August 1949 issue of CIVIL ENGINEERING. The changes, drafted by the Committee on Private Engineering Practice at an all-day meeting just prior to the Board session, involve a complete revision of the section entitled, "Fee Where Scope of Work Is Difficult to Determine," and also revision of the three definitions of salary cost, overhead cost, and travel, subsistence, and other direct expense. No other changes were made.

As revised the three definitions now read:

> **"Salary Cost** includes salaries of architects, engineers, draftsmen, stenographers, clerks, etc., directly chargeable to the project; also all social security contributions, unemployment, excise and payroll taxes, employees compensation insurance, sick leave, vacation and holiday pay for such employees.
>
> **"Overhead Cost** includes general stenographic and clerical payroll with applicable taxes, insurance, sick leave, vacation and holiday allowance; office supplies; general communication expenses, including postage, local telephone, etc.; rent, light, heat, water; depreciation of furniture, equipment and books; nonproductive expenditures, idle time between assignments, maintenance of staff to provide 'readiness to serve'; accounting, new business solicitation, interest on borrowed working capital; local, state, and federal taxes, exclusive of income taxes; general insurance and license fees; bonuses, and participation grants.
>
> **"Travel, Subsistence, and Other Direct Expense** includes living and traveling expenses of all principals or employees in visiting site, attending conferences, etc.; living and traveling allowances of field supervisory and inspection staff; long distance telephone calls, telegraph expenses; duplication expenses, including blueprinting, mimeographing, photostats, etc.; directly chargeable to the project.

The revised section entitled, "Fee Where Scope of Work Is Difficult to Determine," is moved to the end of the report, following the definitions. As revised this section now reads:

> "There are numerous cases where the extent of engineering services required is difficult of ascertainment. Under such circumstances, it is difficult to establish fees on a percentage basis, which are equitable to both client and engineer. In some cases involving mainly partners' or officers' time, per diem rates, mutually agreed to by the client and the engineer, are recommended with reimbursement of travel, subsistence and other direct expenses. In other cases involving mainly employees' time, a reasonable fee would be one based upon all salary cost as defined above plus at least 100 percent of such cost. The allowance of 100 percent shall be considered to include overhead cost, compensation for partners' or officers' time, and profit. In addition thereto, the engineer shall be reimbursed for all travel, subsistence and other direct expense. Salary cost, overhead cost, and travel, subsistence, and other direct expense shall be considered to be as defined above.
>
> "Where by law or custom, salary costs as defined are not acceptable to the client, a reasonable fee would be one based on actual payroll costs plus an adequate percentage or allowance to cover all overhead plus a percentage mutually agreed to by the client and the engineer to cover partners', officers', or principals' time and profit. In addition thereto, the engineer should be reimbursed for all travel, subsistence and other direct expense as above defined."

The foregoing changes became necessary when the Board in July changed a percentage figure before adopting the report and ordering its publication. The Committee on Private Engineering Practice immediately requested that further distribution of the report be halted until the matter could be clarified, and called a meeting of the Committee in Washington for the day preceding the next Board session. Thorough discussion clarified the issue, and on October 31 the resulting changes were adopted by the Board without further amendment.

Prior to this meeting of the Board, and in response to urgent requests from many consulting engineers, a limited number of reprint copies of the report had been released with a warning that changes might be made at the next Board meeting. It is therefore urgently requested that all original reprint copies (Society publication 1949–1 dated July 11, 1949) be returned at once to Society headquarters. They will be replaced, without charge, by copies of the revised report (Society publication 1949–1—Revised, dated October 31, 1949). All pending orders will be filled as quickly as possible. Prices are 10 cents a single copy, five copies for 35 cents, or 5 cents a copy in lots of ten copies or more. Address the Executive Secretary, ASCE, 33 West 39th Street, New York 18, N.Y.

SOME OF OFFICIAL DELEGATES to Local Section Conference and others interested in Section affairs are photographed here. Left to right, bottom row, are Frederick H. Paulson, president, Providence Section; Gurney H. Dayett, president, Maryland; Donald P. Reynolds, Assistant to Secretary, ASCE; George E. Brandow, Los Angeles; and Evan W. Vaughan, president, Syracuse. Second row, Albert E. Johnson, secretary-treasurer, South Carolina; Robert R. Sheridan, president, Rochester; Charles J. Stevens, secretary, District of Columbia; Perley A. Rice, chairman of Conference; Neville C. Courtney, president, Philadelphia; Alfred Hedefine, secretary, Metropolitan and Robert Crispen, secretary-treasurer, Lehigh Valley. Third row, Lynn Perry, president, Miami; James M. Roberts, vice-president, Georgia; W. B. Hovey, president, Venezuela; James M. Faircloth, president, Alabama; Earle F. Littleton, secretary, Northeastern; L. V. Downs, president, Spokane; Robert P. Vreeland, secretary, Connecticut; Russell DeGrove, Florida; Ralph G. Champagne, vice-president, Mohawk-Hudson; and Harold I. Howell, vice-president, Buffalo. Fourth row, D. S. Wallace, president, Virginia; Ernest M. Titus, president, Tennessee Valley; Wilfred Bauknight, Pittsburgh; Thomas Guardia, president, Panama; Warren G. Keith, secretary, Alabama; A. L. Ahlf, secretary-treasurer, Colorado; and Joseph H. Ehlers, ASCE Field Representative, Washington, D.C.

Local Section Conference Studies Expanding Section Program

THE EXPANDING NEEDS of the Local Sections and adequate programming to meet these needs were prime topics of discussion at the two-day Conference of Local Sections held in Washington during the Fall Meeting. Typical of these discussions was that led by Conference Chairman Perley A. Rice, former president of the Virginia Section, on "Local Section Activities Essential to Vigor of ASCE." Mr. Rice detailed ways in which it is essential for the Society to maintain a forward pace in sharing information, advancing the science of engineering, promoting the professional welfare of members, and improving the quality of services to the public through work at Section level.

The growing program of Sub-Sections and Branches was discussed under the leadership of Ernest A. Titus, president of the Tennessee Valley Section. Mr. Titus outlined the organization and operation of the Sub-Sections of the Tennessee Valley Section, which have served as an example for similar development in other Sections with problems of geography. Russell De Grove, a director of the Florida Section, headed a discussion entitled, "Local Section Publications a Boost to Active Section Membership." According to Mr. De Grove, there was a marked increase in meeting attendance following publication of the Florida Section "News."

Outlining the program of the Metropolitan Section in encouraging the work of Student Chapters in its area, Alfred Hedefine, Section secretary, urged an interchange of meeting information, joint meetings, and prize programs as steps in integrating the work of Sections and Chapters.

Possibilities of cooperation with other engineering organizations in a Section area were talked over in one session, under the leadership of Mr. Rice. This led naturally to a discussion of cooperation of engineering organizations on the national level. ASCE Executive Secretary William N. Carey led this section of the conference, relating the achievements of Engineers Joint Council in unifying and strengthening the profession.

Discussion of ways of gaining representation of engineers on public boards and commissions was launched by the reading of an address prepared by ASCE Director Harland C. Woods, who was unable to attend the Conference. Other subjects studied included "Procedures for Encouraging Engineers to Apply for ASCE Membership," led by Assistant Secretary E. L. Chandler, and "Integration of Juniors Into Student Activities," led by Don P. Reynolds, Assistant to the Secretary of ASCE.

Twenty-six East Coast Sections were represented at the Conference by officially appointed delegates, including representatives of the Panama and Venezuelan Sections. Sections throughout the country, from as far west as Spokane and Los Angeles, had members in attendance and taking part in the discussion. Joint meetings with officers of the Society and the District of Columbia Section were other features of the two-day program in Washington.

Board Elects Five to Honorary Membership

AT ITS FALL Meeting in Washington the Board of Direction elected to honorary membership five engineers who are outstanding in their fields of specialization: Charles B. Breed, William P. Creager, Wilford W. DeBerard, Theodor von Kármán, and Wilbur M. Wilson.

Mr. Breed has combined teaching and consulting work in a highly successful career. From 1899 to 1944 he was on the staff of Massachusetts Institute of Technology—for the last ten years of this period as head of the civil engineering department. As a consulting engineer in private practice in Boston since 1916, he has advised on grade-crossing elimination projects, transportation, and public utility valuation projects all over the country. At present he is consultant to Cook County, Illinois, on the Congress Street Superhighway project, involving elimination of many grade crossings at a cost of $45,000,000. He is a former Director of ASCE.

A specialist in hydraulic engineering, William P. Creager has had a consulting engineering practice in Buffalo, N.Y., since 1930. He is author and co-author of five authoritative engineering texts, and has written many articles on hydraulic engineering subjects. Mr. Creager has given much time and valuable service to ASCE Technical Divisions and committees, and currently is a member of the U.S. Committee on International Soil Mechanics Conference and of the International Committee on Large Dams.

City engineer of Chicago and editor of distinction is W. W. DeBerard. As Western editor of *Engineering News-*

Record for many years, Mr. DeBerard contributed notable articles on engineering projects in the Middle West, including an outstanding series on the disastrous Mississippi River Flood of 1927. Since 1941, when he became city engineer of Chicago, Mr. DeBerard has been particularly active in improvement and distribution of the city water supply and modernization of its bridge facilities. He is a former Director of ASCE.

A world renowned aerodynamicist and long-time scientific adviser to the U.S. Air Force, Dr. Theodor von Kármán is at present on leave of absence from the California Institute of Technology, where he is adviser to the Guggenheim Laboratory of Aeronautics and of the Jet Propulsion Laboratory. Since 1944 Dr. von Kármán has been assisting in planning the long-range research program of the Air Force. He formed the Scientific Advisory Group and was sent abroad during the war for a survey of technical developments.

Wilbur M. Wilson, research professor of structural engineering at the University of Illinois since 1922, has done notable pioneer work in investigation of the fatigue strength of riveted and welded structural members. A former Director of the Society with a long record of service on ASCE Technical Division committees, Professor Wilson represented the Society at the atomic bomb tests at Bikini in 1946.

Local Sections Cooperate in ASCE Technical Program

WITH THE OBJECT of improving the Society's technical program each Local Section has been requested to appoint a Committee on Technical Activities. This originated from a special committee of ASCE, which has been formulating a program during the past year and is now named the Committee on Local Section Technical Coordination.

The ASCE Committee, of which Alfred J. Ryan is chairman, is charged with providing a direct means of communication between Local Sections and those responsible for the technical and publication activities of the Society. It proposes to provide each Local Section Committee with detailed information on the conduct of ASCE Technical Division activities, and to coordinate the relationship between Local Sections, the Divisions, and their publication activities. By this means prompt consideration can be given to all matters brought to the Committee's attention by members conducting technical activities of the Society.

Local Section Committees on Technical Activities will have the duty of disseminating to Section members information received from the Society's Committee, and of returning to it useful suggestions and criticisms regarding the conduct of the Society's technical program.

By keeping itself informed regarding the technical activities and procedures of the Society each Section Committee will be in a favorable position to advise interested members how to proceed in making a technical contribution to the Society, in the form of a paper, or service on a committee. Such coordination will serve, the Committee feels, to forestall discouraging cases of duplication of effort which now occur. Finally, it will aid in determining the advisability of preparing a paper prior to its preparation rather than after the onerous work of preparation has been completed and the paper submitted for publication.

Several Local Sections have their committees in operation. Prompt notice to Society headquarters regarding the personnel of newly appointed committees is desired.

Colorado Section Forms Local Technical Divisions

August L. Ahlf, Secretary, Colorado Section

THE COLORADO SECTION has this year formed four Technical Divisions to provide opportunity for the discussion of problems of a more technical nature than is usually presented at the monthly Section meetings. These Technical Divisions are patterned after the following Technical Divisions of the Society: Soil Mechanics and Foundations, Structural, Irrigation, and Hydraulics.

The unusually large concentration of federal and state engineering organizations, such as the Bureau of Reclamation, Corps of Engineers, State Highway Department in Denver, the University of Colorado, and the Colorado Agricultural and Mechanical College in the near proximity, as well as numerous private engineering firms, have made Denver the logical center of engineering activity in the Rocky Mountain area. The research facilities and specialized personnel of these organizations provide an ample source of technical information and practical knowledge for the successful prosecution of the program.

The meetings held each month, except during the summer, feature prominent engineers who are specialists in their respective fields. Considerable time devoted at each meeting to informal discussion not only permits the introduction of many individual ideas and problems, but encourages active participation in programs by a greater number. As each of the divisions has developed an integrated program for the coming year, progress is being made toward the definite objective of professional improvement in each of the fields indicated.

The need for local Technical Divisions has been evident for sometime. In order that this, as well as other needs of the Colorado Section, could be explored, a special "Committee on Society Policy" was formed "for the purpose of studying the general over-all policy of the American Society of Civil Engineers with a view to improving interest, expanding activities, and broadening the influence of the Society, particularly in the Colorado Section." This committee recommended, among other things, that a committee be appointed by the Colorado Section to pursue to a logical conclusion the formation of Technical Divisions by the Section and an integrated program for technical advancement. A survey of ASCE members throughout the state indicated that sufficient interest existed to warrant the immediate formation of the four divisions named, and that other divisions should be formed in the future as the need arises.

The organization of each of the local Technical Divisions is very informal. The officers are elected for terms of one year and the meetings are conducted without benefit of constitution or by-laws. While close contact is maintained between the officers of the Colorado Section and each Technical Division, no jurisdiction is exercised by the Section. Aside from mailing announcements of organization meetings and including notices of the Technical Division in the regular meeting notices of the Local Section, the Technical Divisions handle their own affairs. The cost of operating these Divisions is covered by voluntary contribution by the interested members.

As membership in the Technical Divisions is not restricted to ASCE members, the meetings are attended by a large number of engineers from foreign countries, who are training and studying in this area, recent graduates, and other prospective Society members.

The interest displayed at the meetings, the quality of the papers and discussions presented, and the increase of

interest shown in the affairs of the Section, indicate that the formation of the Technical Divisions will benefit not only the Colorado Section, but the Society as a whole.

Revised Code of Ethics Is Adopted by Board

The principal change in the Code of Ethics made by the Board at the Washington meeting concerns competitive bidding. The complete text of the revised Code of Ethics follows.

IT SHALL BE considered unprofessional and inconsistent with honorable and dignified bearing for any member of the American Society of Civil Engineers:

1. To act for his clients* in professional matters otherwise than as a faithful agent or trustee, or to accept any remuneration other than his stated charges for services rendered his clients.
2. To attempt to injure falsely or maliciously, directly or indirectly the professional reputation, prospects, or business of another Engineer.
3. To attempt to supplant another Engineer after definite steps have been taken toward his employment.
4. To participate in competitive bidding on a price basis to secure a professional engagement.
5. To compete with another Engineer for employment on the basis of professional charges, by reducing his usual charges and in this manner attempting to underbid after being informed of the charges named by another.
6. To review the work of another Engineer for the same client, except with the knowledge or consent of such Engineer, or unless the connection of such Engineer with the work has been terminated.
7. To advertise in self-laudatory language, or in any other manner derogatory to the dignity of the Profession.
8. To use the advantages of a salaried position to compete unfairly with engineers in private practice.
9. To act in any manner or engage in any practice which will tend to bring discredit on the honor or dignity of the Engineering Profession.

* The word "clients" is considered to be inclusive of the meaning of the word "employers."

Revision adopted Washington, D.C., November 1, 1949.

A. W. K. Billings, Honorary Member of ASCE, Is Dead

ASA W. K. BILLINGS, Honorary Member of the Society, died on November 3 in San Diego, Calif., where he had lived since his retirement two years ago as president of the Brazilian Traction Light & Power Co. He was 73. In recognition of Mr. Billings' work in developing the hydroelectric resources in the São Paulo-Rio de Janeiro area, the Brazilian government awarded him the National Order of the Southern Cross, its highest non-military decoration, at the time of his retirement.

A native of Omaha, Nebr., Mr. Billings was in Brazil for 25 years, having gone

A. W. K. Billings, 1876–1949

there as vice-president and construction manager of the Brazilian Traction Light & Power Co. in 1922. Notable among his accomplishments in Brazil was the damming up and reversing the flow of streams in the São Paulo area to take advantage of a 2,000-ft drop from the mountainous plateau to the coastal plain. In addition to providing cheap power, which has had a profound effect on industrialization of the area, the project has been valuable for flood control. Mr. Billings was also responsible for the design and construction of large hydroelectric installations for several Brazilian utilities.

Before going to Brazil Mr. Billings was engaged in construction work in Cuba, Spain, and Mexico. In World War I he was in the Navy—first as works superintendent of the New York Navy Yard in charge of mechanical and electrical work, and later as officer in charge of the construction of naval aviation stations in Europe, with the rank of commander. For his services he received the U. S. Distinguished Service Cross and the French Legion of Honor. He was an honor graduate of Harvard University, class of 1895.

A full member of the Society since 1908, Mr. Billings was elected Honorary Member in 1946. He was also a member of the American Society of Mechanical Engineers, the American Institute of Electrical Engineers, the Institution of Civil Engineers of London, and many other technical societies.

Former Society Director James F. Sanborn, Dies

FORMER ASCE DIRECTOR James F. Sanborn, New York City consultant and expert on construction of municipal water supply projects, died suddenly in Framingham, Mass., on November 12. He was 73. A graduate of the Lawrence Scientific School of Harvard University, Mr. Sanborn was division engineer with the New York City Board of Water Supply from 1905 to 1918 engaged on construction of the metropolitan supply project.

As a member of the New York consulting firm of Sanborn & Bogert (now Sanborn & Fitzpatrick) since 1919, Mr. Sanborn had served as a consultant on numerous supply, sanitation, and transit projects in the New York area. He was also consulting engineer for the Massachusetts Metropolitan District Water Supply Commission, and had acted as arbitrator in various engineering disputes and as expert witness in contract cases. He was co-author with C. P. Berkey of *Engineering Geology of the Catskill Water Supply*, and had written many articles for technical publications.

A full member of ASCE since 1920, Mr. Sanborn served a term as Director from 1933 to 1935. He also belonged to the

James F. Sanborn, 1876–1949

American Institute of Consulting Engineers, the New York Society of Municipal Engineers, the American Public Health Association, the American Water Works Association, and the New England Water Works Association.

NOTES FROM THE *Capital*

Joseph H. Ehlers, M. ASCE
Field Representative, ASCE

WITH THE RECENT session of Congress ended, this report from the Nation's Capital will be devoted to a summary of legislative action that appears to be of particular interest and significance to the profession.

One of the most important accomplishments was in maintaining the status quo with regard to the "professional" provisions of the Labor-Management Act. It seems likely that these provisions are safe, at least until 1951, but that the Engineering Societies' panel will have to maintain an alert defensive position.

The important "advance planning" legislation (P.L. 352) passed in the last days of the session promises to provide a sound engineering background for local public works, particularly in the event that a public works assistance program is eventually found desirable. Applications for advances of funds will be accepted after December 1.

The Alaska Public Works bill (P.L. 264) is of interest regionally to engineers. A group of engineers and executives from the General Services Administration, under whose jurisdiction the program will operate, recently left for Alaska to establish an office there.

The advance planning of federal public buildings and acquisition of sites for them is provided for in Public Law 105. An appropriation of $12,000,000 was made available to carry out these purposes (P.L. 430).

In the Housing Act of 1949 (P.L. 171), there is a noteworthy section dealing with urban redevelopment with provisions for making loans and capital grants. This may be of importance to engineers inasmuch as any large-scale urban redevelopment program necessarily involves city planning and consideration of highways and other public facilities. This law also makes provision for research.

The executive pay-raise bill (P.L. 359) will include large pay raises for a few engineers in top administrative positions. The Classification Act of 1949 (P.L. 429) provides small increases in pay for career employees.

Appropriation bills carried ample funds to continue existing programs for reclamation work (P.L. 350), for the civil functions for the Corps of Engineers (P.L. 355), and for airport construction (P.L. 179).

Legislation Laid Over

No important piece of legislation supported by the profession received a final adverse verdict during the session. However, several matters of great importance still remain unaccomplished. Among these may be mentioned the National Science Foundation legislation, in which the Engineers Joint Council panel had succeeded in having incorporated the provisions relating to engineering that were left out of the original bill. Another matter that has not emerged from committee is the District of Columbia "Professional Engineers' Registration Act" (H.R. 1188).

One matter that will undoubtedly receive extended consideration in the coming session is the President's Point IV program involving technological and financial assistance in the development of so-called backward countries. The Engineering Societies must crystallize their views on this subject in order to take a position consistent with sound financial policy, helpful to the profession, and in the public interest.

The elimination of competitive bidding for professional services has been one of the objectives of the work of this office. Ordinarily, action is taken in respect to individual cases. The situation is satisfactory with reference to most of the major engineering bureaus. The profession would, of course, like to see more sweeping regulations covering the matter. One possibility that this office has been following up is the extension of the provisions of the General Services Act (P.L. 152). This Act permits contracts for professional services to be entered into without competitive bidding and permits the General Services Administrator to grant similar authority to other agencies that are not required by specific law to take competitive bids. It is believed that improvement will be effected in this field.

The setting of fee schedules for engineering services for government agencies presents considerable difficulty, and efforts are under way to adjust some unsatisfactory schedules, particularly in the housing field. Another matter of interest to the construction industry is the current work in revising the standard government contract, Form 23. The principal organizations connected with the construction industry, including ASCE, are being given opportunity to submit suggestions.

Washington Office Will Obtain Copies of Bills

Copies of any of the above-mentioned laws or bills may be obtained from your congressman. Or as a service to the Local Sections of the Society, this office will undertake to obtain a copy of any of them for the use of a Local Section upon its request.

The Federal Security Administrator recently announced the formation of a Division of Engineering Resources in the Bureau of State Services of the U.S. Public Health Service. This new division will centralize planning and development of current and proposed programs in the expanding field of sanitary engineering and environmental health.

Fall Meeting Committees Commended

Although the Fall Meeting is described elsewhere in this issue, we would feel remiss if we did not remark on the fine job done by the committees of the District of Columbia Section in making this an outstanding meeting.

Alfred Noble Prize Goes to Mechanical Engineer

THIS YEAR'S WINNER of the Alfred Noble Prize is John Crocker Fisher, a mechanical engineer and junior member of the ASME, for a paper on "Anisotropic Plastic Flow." Presentation of the prize was made at the annual dinner meeting of the ASME in New York on November 30.

John C. Fisher

Mr. Fisher was born in Ithaca, N.Y. Following graduation from Ohio State University with the B.A. degree in mathematics in 1941, he spent a year at the Battelle Memorial Institute as research engineer. From 1942 to 1947 he was an instructor in mechanical engineering at the Massachusetts Institute of Technology. Since then he has been research associate at the General Electric Research Laboratory in Schenectady, N.Y.

The Alfred Noble Prize, which was established in 1929, is endowed by a fund contributed by friends of Mr. Noble, former President of the ASCE, in his honor. The prize, consisting of a cash award of $350 and a certificate, is awarded annually to a young member of one of the four Founder Societies or the Western Society of Engineers for a published technical paper of unusual merit.

NEWS OF LOCAL SECTIONS

Coming Events

Buffalo—Luncheon meeting at the Athletic Club, Buffalo, December 21, at 12:15 p.m.

Central Ohio—Meeting at the Hotel Chittenden, Columbus, Ohio, December 8, at 6:30 p.m.

Colorado—Dinner meeting December 12, at 6:30 p.m.; technical meeting at 8 p.m. Section luncheon every Wednesday at Daniels & Fishers Department Store at 12 noon. Full details may be obtained by phoning A. L. Ahlf or K. L. Fienup at Tabor 2181 Ext. 332.

Connecticut—Meeting at the Hotel Bond, Hartford, December 13, at 6:30 p.m.

Duluth—Luncheon meeting at the Kitchi Gammi Club, Duluth, December 19, at 12:15 p.m.

Georgia—Annual meeting at the Georgia Institute of Technology on December 10.

Indiana—Meeting at the Canary Cottage, Indianapolis, December 20.

Kansas—Meeting in Topeka on December 16.

Los Angeles—Writing the engineering specifications will be the theme of a seminar, sponsored by ASCE with ASME and AIEE cooperating, in the Mechanical Engineering Building of the California Institute of Technology, Pasadena, December 21.

Maryland—Dinner meeting at the Engineers Club, Baltimore, December 14; dinner at 6 p.m. and meeting at 8 p.m.

Metropolitan—Meeting in the Engineering Societies Building, New York, December 21, at 8 p.m.

Mid-South—Annual meeting at the King Cotton Hotel, Memphis, Tenn., December 9 and 10.

Montana—Meeting in Helena on December 9.

Northeastern—Meeting at Northeastern University, Boston, December 19, at 6 p.m.

Northwestern—Annual meeting at the Coffman Memorial Union, University of Minnesota, Minneapolis, December 5.

Philadelphia—Meeting at the Engineers Club of Philadelphia on December 13.

Pittsburgh—Meeting of the Pittsburgh Section Juniors at the downtown YMCA on December 15.

Sacramento—Regular luncheon meetings at the Elks Club, Sacramento, every Tuesday, at 12:30 p.m.

San Francisco—Annual meeting at the Engineers Club on December 20, at 6 p.m.

Seattle—Meeting at the Engineers Club, Seattle, December 28, at 6 p.m.

Wisconsin—Annual meeting in the Engineering Society of Milwaukee Building, Milwaukee, December 15.

Recent Activities

AKRON

TOPOGRAPHIC MAPPING BY photogrammetric methods was discussed at a recent meeting of the Akron Section, which featured the showing of a U.S. Geological Survey film on the subject. The film was presented by Section Vice-President Sherman Swigart. Martin P. Lauer, president of the Section, reported the recent Clifty Falls meeting of Sections in District 9.

CENTRAL OHIO

OBSERVATIONS ON THE current inventory of ground-water resources in the Chillicothe area were presented at a recent dinner meeting by Fred Keeler, Ross County agricultural agent. The large number of paper mills in the Chillicothe area have placed heavy demands on the ground-water supply, according to Mr. Keeler. On an average, the amount of water pumped exceeds 25,000,000 gpd. During the evening, the proposed periodical conference of Local Sections in District 9 was discussed.

COLORADO

FUNDAMENTALS INVOLVED IN the prestressing of concrete were outlined at a recent dinner meeting by Carlos D. Bullock, regional structural engineer for the Portland Cement Association, Kansas City, Mo. Mr. Bullock supplemented his talk with a moving picture made in Belgium, showing the work of Prof. Gustave Magnel at the University of Ghent in developing the use of steel cables of high tensile strength to prestress concrete beams. Also illustrated was the European use of the method in construction of concrete warehouses, hangars, bridges, water tanks, and pipes. During the evening, the Section Committee on Awards presented a Junior membership in the Society to W. G. Wilkinson, who has been named outstanding member of the Chapter at Colorado A. & M. College.

GEORGIA

ASCE PRESIDENT FRANKLIN Thomas reviewed current activities of the Board of Direction at a recent dinner meeting of the Georgia Section held at Georgia Institute of Technology. President Thomas was introduced to the audience of about 70 by Cherry Emerson, vice-president of the Institute. Prior to the meeting, a prearranged radio program was recorded by President Thomas and Comdr. Charles M. Thomas, chairman of the Publicity Committee of the Georgia Section, in the studio of WGST, sponsored by the Institute. President Thomas outlined the history and achievements of the Society, and Commander Thomas of the Georgia Section. Later the combined recordings were broadcast from Station WGST, as part of a local program to publicize the Society and the profession.

ILLINOIS

PARTICIPATING IN A recent civic program, the Illinois Section was one of five national organizations aiding in the establishment of a set of basic zoning principles for the Chicago area. Other groups represented in the two-day conference devoted to industrial planning problems were the American Railway Development Association, the Association of State Planning and Development Agencies, the American Institute of Planners, and the Society of Industrial Realtors, a division of the National Association of Real Estate Boards. The recommendations of the group primarily recognize the necessity for preserving sufficient manufacturing sites to "provide a balanced

Scheduled ASCE Meetings

ANNUAL MEETING
New York, N.Y., January 18–20
(Board of Direction meets January 16–17)

SPRING MEETING
Los Angeles, Calif., April 26–29
(Board of Direction meets April 24–25)

ANNUAL CONVENTION
Toronto, Canada, July 12–14
(Board of Direction meets July 10–11)

FALL MEETING
Chicago, Ill., October 11–13
(Board of Direction meets October 9–10)

economy" and to prevent non-industrial uses (such as housing and slum-clearance developments) from encroaching on land best suited to industry. The group will endeavor to have its recommendations adopted by all public planning agencies throughout the country.

LEHIGH VALLEY

THE THEORY OF prestressed concrete structures was discussed before the Lehigh Valley Section by E. R. Schofield, principal assistant engineer for the Philadelphia Bureau of Engineering, Surveys, and Zoning. Mr. Schofield described European concrete structures incorporating the method, which he had viewed on a recent trip to Europe, and showed Prof. Gustave Magnel's plan on the subject. He also described the Walnut Lane Bridge now under construction in Philadelphia, which was designed under his direction.

MIAMI

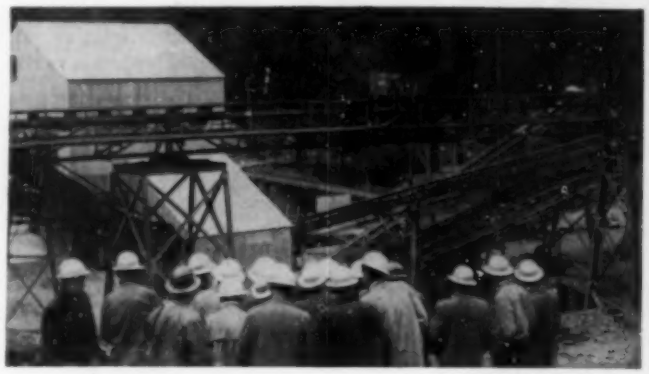
METHODS NOW AVAILABLE in the Miami area for the construction and financing of homes were outlined at the November dinner meeting by Thomas P. Coogan, local engineer and contractor and director of the Florida Association of Home Builders. Claude F. Wertz, resident engineer for the Miami Department of Water and Sewers, then showed motion pictures depicting the construction of a reinforced concrete pipeline recently built for the Miami water supply. He and H. J. Morrison, who was also on the job, discussed the project.

MID-SOUTH

ASCE DIRECTOR WEBSTER L. BENHAM attended the recent two-day fall meeting of the Mid-South Section in Little Rock, Ark., and briefed the group on Society affairs and current activities of the Board of Direction. A diverse technical program included papers on "Investigation of the Application of the Vacuum Process to Mass Concrete Construction," by Cecil H. Willetts, of the Concrete Research Division of the Waterways Experiment Station; "Foundation Problems at Little Rock Veterans Administration Hospital," by Flournoy W. Sims, of the Corps of Engineers at Little Rock; and "Engineering Education in Arkansas and Adjacent States," by George F. Branigan, dean of the College of Engineering at the University of Arkansas. The guest speaker at the evening banquet was Peyton N. Rhodes, president of Southwestern University, who ad libbed charmingly for the ladies and read a paper on the founders of modern mathematics for the engineers.

MONTANA SECTION

INSPECTION OF THE Hungry Horse dam site comprised the Section's first meeting of the fall season. Garbed in hard hats and raincoats, the group was taken on a conducted tour of the work by E. J. Nieman, engineer for the Bureau of Reclamation on the project. The mouth of the glory hole spillway shaft, the concrete batch, aggregate washing, and separating plants, and the work being done in the fault areas preliminary to keying in the structure were inspected. The program at another recent meeting consisted of the showing of a film dealing with the manufacture and use of asbestos cement high pressure pipe by Howard Harvey, representative for the Johns-Manville Co.



MEMBERS OF MONTANA SECTION visit site of Hungry Horse Dam, now under construction by Bureau of Reclamation.

INDIANA

DISPOSAL OF HOUSEHOLD garbage and refuse incineration were discussed in the leading talk at the November dinner meeting by Mark P. Owen, Indianapolis consultant. During the business session, considerable interest was expressed in the proposed District 9 Council of Local Sections, which was explained by K. B. Woods, secretary-treasurer of the Section.

MARYLAND

A GENERAL PICTURE of the engineering situation in Latin America was given at a recent meeting of the Maryland Section by S. S. Steinberg, dean of the School of Engineering at the University of Maryland and chairman of the EJC Committee on Latin America. As background material for his talk, Dean Steinberg described the resources and general progress of the 20 countries south of the border. In general, he said, modern engineering education in the universities is all theoretical, with little or no laboratory work. Lectures are given by part-time faculties who have few books at their disposal. No research or practice is required for graduation. It is difficult to get into engineering practice there, he said, as there is no reciprocity and firms have to be owned locally. Of recent years Dean Steinberg has been in Latin America several times making a survey of engineering colleges and institutions for the State Department.

METROPOLITAN

FINANCING NEW JERSEY'S new toll superhighway by the sale of revenue bonds will make it possible to complete "an unexcelled, free-flowing traffic artery for all classes of automotive traffic" in two years, Charles M. Noble, chief engineer of the New Jersey Turnpike Authority, declared in the feature talk at the November meeting of the Metropolitan Section. If the project were undertaken in the normal way, it could not be completed in 35 years, Mr. Noble stated. He stressed the engineering and safety features to be incorporated in the new 118-mile throughway, such as a wide dividing strip between opposing lanes of traffic, wide stabilized shoulders, and adequate service areas for the comfort and convenience of users. Maximum grades, Mr. Noble said, will be 3 percent, and curves will be long and sweeping to assure rapid and safe transportation. He told the group that preliminary engineering surveys, made in the record time of 120 days, indicated that the project is financeable on a self-liquidating basis. A capacity crowd of 450 heard the talk.

Two of the recommendations of the Hoover Report have already been adopted, according to Sidney M. Sha-

TOTAL MEMBERSHIP AS OF NOVEMBER 9, 1949

Members	7,471
Associate Members	9,581
Corporate Members	17,052
Honorary Members	36
Juniors	10,073
Affiliates	75
Fellows	1
Total	27,237
(November 9, 1948	24,429)

piro, deputy chief engineer of the Long Island State Park Commission and consultant to the Public Works Task Force of the Hoover Commission. Addressing a recent meeting of the Junior Branch, Mr. Shapiro stated that these recommendations are the transfer of the Bureau of Public Roads to the Department of Commerce, and the establishment of the General Services administration. Mr. Shapiro advocated creation of a Department of Public Works, manned by engineers, and stated that much remains to be done in the way of reorganization.

LOUISIANA

SEDIMENTARY GEOLOGY OF the alluvial valley of the Mississippi and its influence on foundation problems was the subject of the featured talk at a recent joint meeting of the Section and the Louisiana Post of the Society of American Military Engineers. This was given by Willard J. Turnbull, chief of the Soils Division of the U.S. Waterways Experiment Station, who explained how river deposits down through the ages have affected surface loading conditions and foundation design.

NORTHWESTERN

THE HISTORY AND growth of the Minnesota Mining & Manufacturing Co., in relation to the development of the Minneapolis area were discussed at the Section's November meeting by Fred Manley, sales manager of the company. Mr. Manley described the use of the organization's products by the armed forces during the war and their place in peacetime economy.

PHILADELPHIA

WELDED STEEL CONSTRUCTION was the topic of discussion at the November meeting of the Philadelphia Section. The leading speaker was Howard O. Hill, assistant chief engineer for the Fabricated Steel Division of the Bethlehem Steel Co., and immediate past-president of the American Welding Society. Discussion was headed by William E. Hendricks, production manager of the Belmont Iron Works, who described his experiences with shop welding of fabricated steel.

PITTSBURGH

PROBLEMS ENCOUNTERED IN design of the Penn-Lincoln Parkway were reported at a recent meeting of the Pittsburgh Section by a trio of Juniors. John McDermott spoke on the Point Park Interchange; Charles Way, on the superstructure; and James Baer, on the substructure. Malcolm Corner, president of the Section Juniors, and Edmund Byrkit also spoke briefly. The program, which was prepared and presented entirely by Juniors, was widely commended by the 165 engineers present. At another recent meeting of the Pittsburgh Section, Kurt Billig, internationally recognized authority on prestressing of concrete structures, lectured on the subject and answered numerous questions from the audience.

GROUP OF PITTSBURGH JUNIORS, instrumental in preparing and planning recent highly successful technical program, is shown here. Reading, left to right, are C. R. Way, Malcolm Corner, president of the Junior Division, J. F. McDermott, E. J. Byrkit, and J. F. Baer.

TEXAS SECTION

HOST THIS YEAR to the annual fall meeting of the Texas Section was the recently established San Antonio Branch, which was widely congratulated on the successful outcome of its first major meeting. The attendance of 385 at the two-day meeting included both ASCE President Franklin Thomas and John L. Cunningham, Vice-President from Zone IV. An ambitious technical program, prepared under the chairmanship of Homer Matthews, got under way with talks on the oil industry by T. L. Allen, of the Petty Geophysical Engineering Co., who discussed the role of geophysical exploration in the industry, and E. P. Hubbard, superintendent of production for the Gulf Oil Corp., who described the rotary drilling of oil wells in the Gulf area. During the afternoon session, Harold Vagtborg, director of the Southwest Research Institute, commented on the tremendous problems involved in the intricate relationship between science and engineering. Since 1900, he said, the cost of research in this country has risen from practically nothing to about a billion dollars a year. Another paper by Prof. W. L. Moore, of the University of Texas, explained the use of the hydraulic laboratory in modern engineering work. New officers elected for the coming year are: Lowber D. Snow, president; S. R. Wright and F. M. Davis, vice-presidents; and I. W. Santry, Jr., secretary-treasurer. At the customary student breakfast on Friday morning, Vice-President Cunningham talked on the Society. A sightseeing trip over the San Antonio expressways and a visit to the Southwest Research Institute concluded the program.

SOCIETY PRESIDENT Franklin Thomas (left) receives Western Stetson from R. J. Cummins, on behalf of Texas Section, during recent fall meeting at San Antonio. I. W. Santry, Jr., secretary-treasurer of Section, is shown at right.

TEXAS SECTION BOARD OF DIRECTORS for 1950, photographed during recent fall meeting of Section, consists of (left to right) Conrad Blucher, W. E. Simpson, President Lowber D. Snow, Vice-President S. R. Wright, and I. W. Santry, Jr., secretary-treasurer. Vice-President F. M. Davis was not present when photo was taken.

STUDENT CHAPTER Notes

ST. LOUIS

AT A RECENT luncheon meeting devoted almost entirely to Society affairs, ASCE Director Webster L. Benham covered the highlights of the Summer Convention in Mexico City. He also discussed the proposed revision of the constitution and described ASCE committee work, stressing particularly the accomplishments of the Committee on Districts and Zones. Robert B. Brooks, ASCE Vice-President representing Zone III, then gave a talk entitled "Public Engineering Practice and Policy." Mr. Brooks commented also on the proposed Army reorganization and the attitude of the Society in the matter.

TACOMA

UNTIL NOW THE greater part of earthquake knowledge has been of a highly theoretical and mathematical nature, according to Alfred L. Miller, professor of mechanics and structures at the University of Washington and Northwest member of the Advisory Committee on Engineering Seismology. Addressing a recent meeting of the Tacoma Section, Professor Miller pointed out that the majority of earthquake hazards are man-made—namely, falling objects, pipeline fractures, and disruption of utilities and services. Thorough investigation of earthquake action and damage will aid designers in reducing many earthquake hazards of the future, he stressed. "It has been proved," he said, "that earthquake design need not be elaborate or expensive. Proper design, proper use of materials, and common sense are the essential requirements. A structure with earthquake protection may cost slightly more than one without. However, there are examples where considerable savings have actually been made by designing structures for earthquakes rather than ignoring them." "One of the chief problems facing earthquake committees in the Northwest," Professor Miller stated, "is the lack of mandatory earthquake codes. The committees in the area are making a study of codes of other earthquake areas to determine if they are applicable to the region."

TOLEDO

THE SKAGIT PROJECT, which includes Timber Crib, Diablo, and Ross dams, was the topic of discussion at a recent meeting of the Toledo Section. Discussion was headed by Ralph Hansen, structural engineer for the Libby Owens Ford Glass Co., who also showed movies of the project, which is being built under the supervision of the Seattle, Wash., Department of Lighting.

AGRICULTURAL AND MECHANICAL COLLEGE OF TEXAS

ADVANTAGES OF STUDENT Chapter membership and early affiliation with the Society after graduation were stressed by ASCE President Franklin Thomas at a recent banquet meeting sponsored by the J. T. L. McNew Student Chapter of the Agricultural and Mechanical College of Texas. New officers of the Chapter are Cadet Colonel William F. Bohlmann, president; Cadet Captain Ray Kinsey, secretary; and James Tidwell, treasurer. The Chapter boasts a membership of 225.

COLORADO A & M COLLEGE

THE DENVER SEWAGE disposal plant and four highway projects now under construction in the Denver area were inspected recently by members of the Colorado A & M College Student Chapter. During the dinner meeting following the inspection tour, Wilbur Wilkinson was presented with an honor award. The meeting concluded with a talk and motion picture on prestressed concrete.

IOWA STATE COLLEGE

TECHNICAL AND MORAL responsibilities of civil engineering graduates were discussed by Charles Mottier, vice-president and chief engineer of the Illinois Central Railroad, at the initial fall meeting of the Iowa State College Student Chapter. During the meeting Mr. Mottier also outlined the engineering problems encountered in the construction of the Union Railroad Terminal in New Orleans. At the business session, preceding the technical program, members of the Chapter completed plans for an inspection trip to Chicago. The meeting was attended by 200 students.

BROOKLYN POLYTECHNIC INSTITUTE

"BUILDING THE GOLDEN Gate Bridge" was the subject of a Bethlehem Steel Co. film shown recently before 60 members of the evening session of the Brooklyn Polytechnic Institute Student Chapter.

ILLINOIS INSTITUTE OF TECHNOLOGY

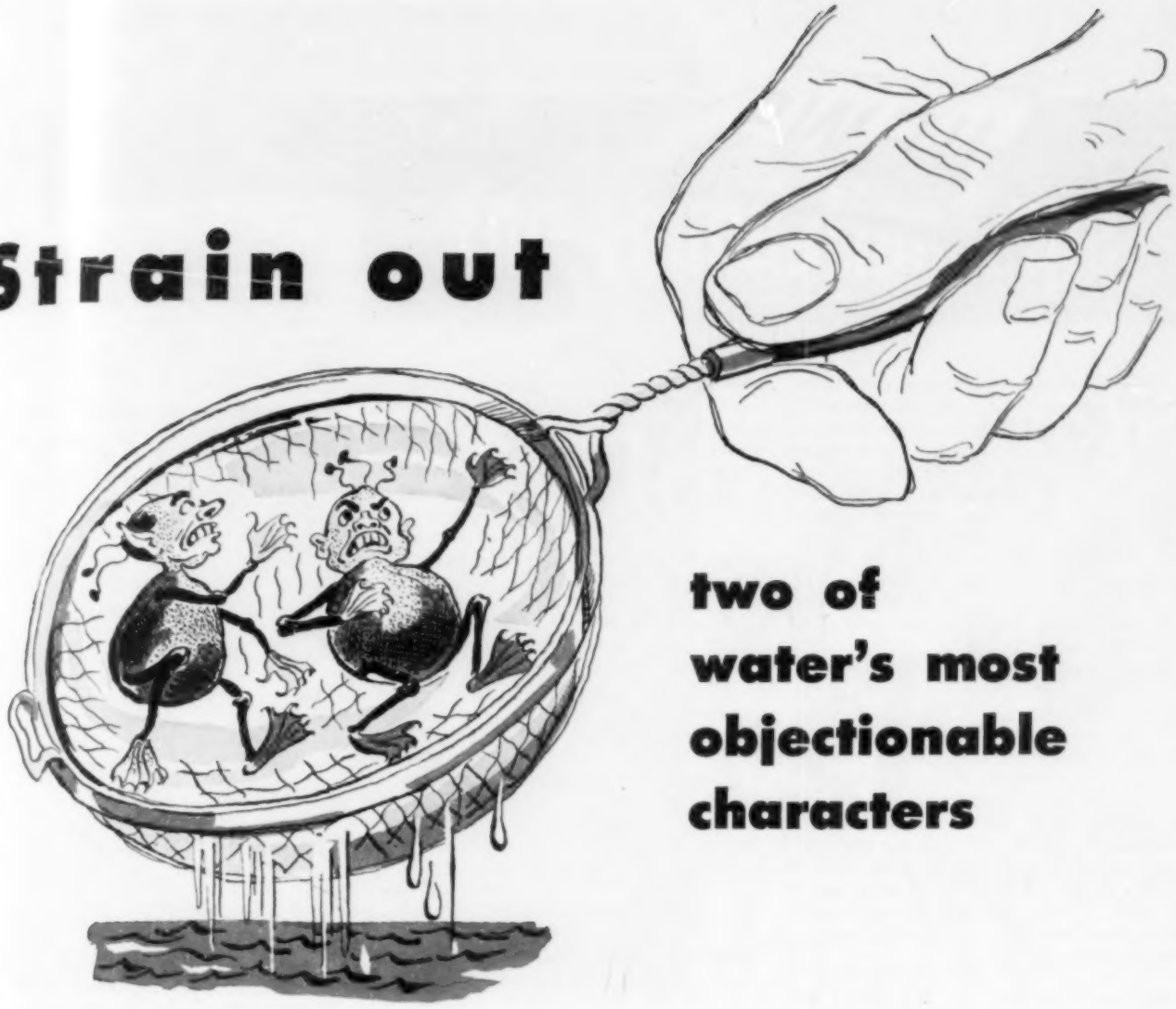
THE ART OF self-expression was the theme of a talk presented at a recent meeting of the Illinois Institute of Technology Student Chapter by Charles E. Burdick, of the Chicago consulting engineering firm of Alvord, Burdick & Howson. Emphasizing the fact that "an incoherent engineer is doomed to a minor position," Mr. Brudick stated, "the ability to express ideas clearly and logically" can be acquired through improved study, example, and practice.

UNIVERSITY OF FLORIDA

AN ILLUSTRATED DISCUSSION on problems facing the highway engineer today was given by A. R. Brickley, regional highway director for the Portland Cement Association, befor the first meeting of the fall term of the University of Florida Student Chapter. A lively question-and-answer period followed. Twelve delegates were chosen for the Annual ASCE Student Chapter Conference to be held in Washington, D.C.

PICTURED AT RECENT BANQUET MEETING of Stanford University Student Chapter are (left to right) ASCE President Franklin Thomas, principal speaker; Eugene Grant, professor of engineering economics; Fabian Miller, city engineer of Palo Alto, Calif.; Prof. Bert Wiles; and Leon B. Reynolds, professor of hydraulics and sanitary engineering.

Strain out



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NEWS BRIEFS

Construction in October Drops Slightly from September Peak Level

CONSTRUCTION ACTIVITY DURING October dropped 2 percent, a less-than-seasonal decline from the September peak level, as further expansion of work on new housing, schools, and hospitals largely offset small seasonal declines in most other types of new construction, the Department of Commerce reports. The total value of new construction put in place during the month was $1,856 million, a slight decline from the September revised total of $1,892 million, and an increase over the October 1948 total of $1,814 million.

Despite the construction drop in October, new building in the first ten months of the year was still more than 1 percent above the total for the corresponding period in 1948 in both dollar value and physical volume, according to estimates of the Construction Division of the Department. By the end of October 1949, the total value of new construction put in place during the year amounted to $15,882 million, a rise of $200 million above the total for the same period in 1948. Though private construction was off 6 percent from last year, public construction was up by 26 percent.

October was the first month this year in which the value of new private housing put in place was larger than the value for the corresponding month last year. Joint estimates of the Departments of Commerce and Labor put the value of private residential building, exclusive of farm dwellings, during the month at $695 million, 2 percent above the September 1949 figure and 4 percent above the total for October 1948, when homebuilding activity was beginning to decline.

Industrial and commercial construction were reported steady in October, but farm construction was down, and privately owned public utilities also began seasonal curtailment of new construction. The contra-seasonal increase in private hospital and institutional construction is attributed to work being done by private non-profit organizations under the National Hospital Program of the U.S. Public Health Service. All major types of public construction, except housing, schools, and hospital building, were off seasonally from September levels. Despite the fact that publicly financed new construction, which amounted to $532 million in October was down 4 percent from the September level, it was still 16 percent above the total for October of last year.

Production of building materials in August increased 18 percent over the lower-than-seasonal output in July, according to the composite index of production for construction materials of the Department of Commerce. Although this increase was three times the normally expected seasonal rise, production in August was 10 percent below that of last August. Over-all production for the first eight months of the year was 11 percent below that for the comparable period of 1948, the Department stated.

Of the 20 materials included in the production index, only cement and rigid steel conduit declined during August of this year. Among materials for which production gains were recorded were such basic construction items as lumber, brick, nails, structural steel, reinforcing bars, asphalt roofing materials, structural clay tile, and sewer pipe.

Registration Gains Noted at Annual Meeting of NSCBEE

PROGRESS BEING MADE in the registration of engineers was reported by delegates from 35 states and representatives of ten national engineering societies at the 28th annual meeting of the National Council of State Boards of Engineering Examiners, held at Daytona Beach, Fla., November 10–12. There are now more than 150,000 registered professional engineers in the United States and its territories, and 11,524 engineers-in-training have been certified by 19 states, T. Keith Legaré, executive secretary of the NCSBEE, stated in the secretary's report. Attention was also directed to the fact that 16 states have amended their laws during the past two years, principally for the purpose of raising standards and making the laws more in accord with the Model Law.

During the annual banquet, distinguished service certificates were presented to D. B. Steinman, M. ASCE, and Dean Erich Hausmann, members of the New York board. A medal "for outstanding service to the profession" went to Alexander Blair, M. ASCE. The featured address of the evening, entitled "Registration—a Dream Come True," was delivered by Dr. Steinman, chairman of the Committee on Registration by Endorsement, and past-president of NCSBEE. Edmund Friedman, ASCE Director, represented the Society.

The following officers were elected for the coming year: Clarence L. Eckel, M. ASCE, dean of engineering at the University of Colorado, president; Russell G. Warner, vice-president of the United Illuminating Co., New Haven, Conn., vice-president; Thomas C. Shedd, M. ASCE, professor of structural engineering at the University of Illinois, director of the Central Zone; and Ned Spaulding, consulting engineer, Hudson, N. H., director of the Northeast Zone. T. Keith Legaré, M. ASCE, of Columbia, S. C., begins his 27th term as executive secretary.

Dean C. L. Eckel

Natural Gas Pipeline Is Built for Oak Ridge Plant

A 170-MILE NATURAL gas pipeline to supply the Atomic Energy Plant at Oak Ridge, Tenn., will be completed in December at a cost of $10,000,000, according to an announcement from Ebasco Services, Inc., which designed the line and is supervising its construction. Designed for an ultimate capacity of 230,000,000 cu ft daily, the 22-in. pipeline will initially deliver 60,000,000 cu ft of gas daily to the plant.

Because of the importance of the line to national security, the pipe is being buried throughout its length to minimize the danger of sabotage, according to the organization. No exposed spans will be permitted, and multiple crossings will be provided at the major rivers traversed.

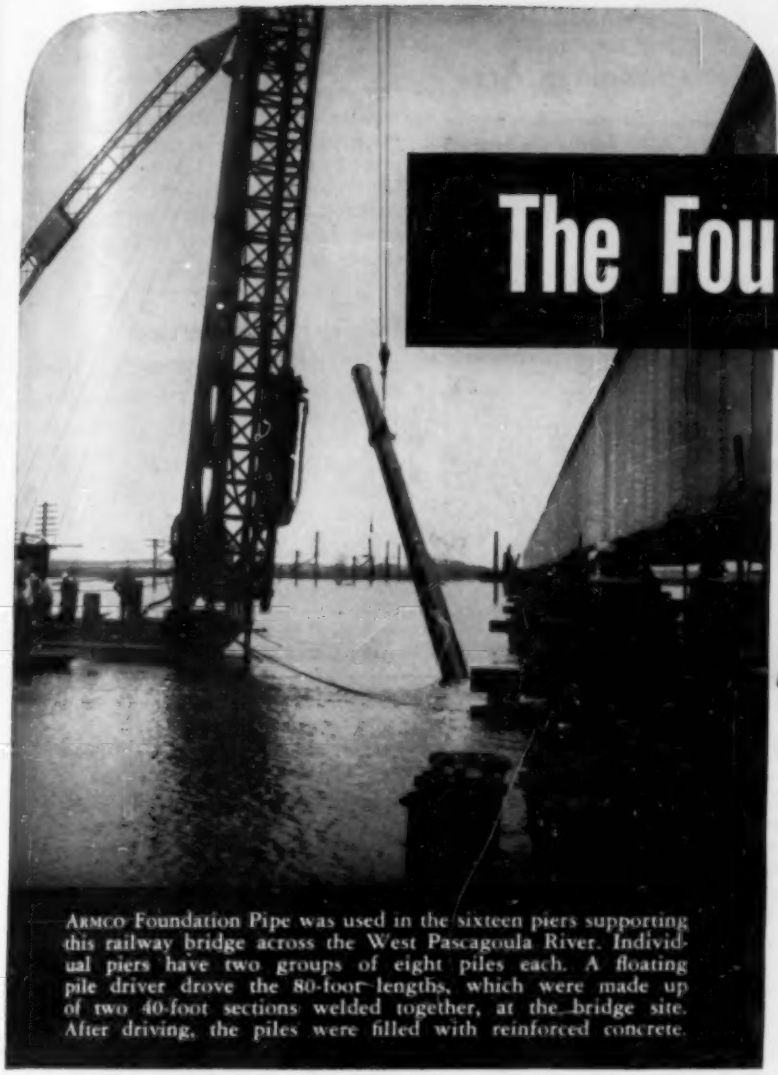
Starting point of the line, which is being built by the Oman Construction Co., is at Greenbrier, Tenn. In addition to supplying Oak Ridge, the line is expected to bring natural gas to the Knoxville, Alcoa, and Maryville area of eastern Tennessee. The Federal Power Commission has been asked to approve construction of an extension of the Oak Ridge line to supply these cities.

Philadelphia Firm Gets White House Contract

A CONTRACT FOR repair of the White House has been awarded to the Philadelphia firm of John McShain & Co., who offered the lowest bid—$100,000 plus actual cost. The work must be completed within 22 months. Total estimated cost of the White House renovation project is $5,400,000.

The Foundation Pipe

with the "BIG 6"



ARMCO Foundation Pipe was used in the sixteen piers supporting this railway bridge across the West Pascagoula River. Individual piers have two groups of eight piles each. A floating pile driver drove the 80-foot lengths, which were made up of two 40-foot sections welded together, at the bridge site. After driving, the piles were filled with reinforced concrete.

When heavy construction projects go on your drafting boards you'll want to look into these six time- and money-saving possibilities of ARMCO Welded Steel Foundation Pipe:

1. A wide range of diameters (6 to 36 inches) and wall thicknesses (3/16-to ½-inch) save money and material because you use light or heavy wall, as needed.

2. By ordering any specified lengths that can be handled and shipped, cut-off losses are reduced and field operations speeded.

3. ARMCO Foundation Pipe is exceptionally round and straight. This reduces the number of crooked or rejected piles, and piles with specified load reduction. It also makes inspection easier after driving.

4. Uniform diameter end-to-end means salvageable cut-offs, constant cross section for good end bearing and high bending resistance throughout the length.

5. Steel end-closure plates, cone drive-points, special-cutting shoes or welding collars can be mill-attached to eliminate inconvenience and cost of field welding.

6. The tough spiral weld imparts high collapse resistance and extra lateral stiffness to even the longest lengths. ARMCO Pipe drives straight and requires only a simple driving head and no mandrel.

Keep that next job right on schedule by using strong, easy-to-handle ARMCO Foundation Pipe. Ask for a quotation on your specific needs. Armco Drainage & Metal Products, Inc., Welded Pipe Sales Division, 1995 Curtis Street, Middletown, Ohio. Export: The Armco International Corporation.

ARMCO FOUNDATION PIPE

ARMCO

Large Motor Truck Terminal to Serve Metropolitan Area

NEW $9,000,000 UNION MOTOR TRUCK TERMINAL, recently opened by Port of New York Authority in lower Manhattan, will serve New York City's five boroughs and part of Hudson County, New Jersey, east of Hackensack River. Terminal occupies three square blocks close to Holland Tunnel, steamship piers, and main arterial routes, and will be important factor in reducing traffic congestion in metropolitan port area. First in projected series to be built by Port Authority, terminal can handle more than 2,000 tons of merchandise freight daily, and will save 1,830,000 truck miles per year. Roof of two-story 1,000 × 175-ft structure, with off-street bays for 144 trucks, can accommodate 70 complete tractor-trailer units for off-street parking. Freight platform, 800 × 80 ft, is equipped with overhead chain conveyor serving both sides of island platform by means of platform trailers.

Contract System Urged for Road Building at Fall Conference of ARBA

HIGHWAY CONSTRUCTION BY the contract system instead of the day labor method was urged by A. C. Clark, acting deputy commissioner of the U. S. Bureau of Public Roads, in a leading talk delivered at the recent fall conference of the American Road Builders Association in Washington, D.C.

Speaking in a panel discussion on "Merits of the Contract System Over Day Labor in Highway Construction," at the opening session of the two-day program, Mr. Clark declared that, "The contract method of construction has always been given preference over the day labor method on federal-aid highway projects. In fact, the regulations controlling the expenditure of federal-aid highway funds require that the construction be performed by the contract method, except in the few special cases when it can be definitely shown that it is in the public interest to use the day labor method."

The day labor method of construction was termed "a cancerous growth we must incise" by Archer B. Gay, Richmond, Va., contractor and builder, and secretary-treasurer of the Virginia Road Builders Association. "The result has always been the same, a total disregard of cost, of time and an utter lack of efficiency," he asserted. "Despite striking proofs of extravagance and inefficiency, and equally impressive proofs of the superiority and economy of the contract method of performing highway construction work, the day labor method continues to raise its head and seek complete dominance in the field of public works."

Stating that "Day labor is highly vulnerable to political manipulation, and no certain means are provided which will assure the owner of the ultimate cost of the project in advance of its actual construction," Mr. Gay added that, "Workmen thus employed, in most cases, lack the small incentive offered in the hope of assured future employment and are prone to perform poor or at least indifferent work."

A similar view was expressed by Charles M. Upham, M. ASCE, engineer-director of the ARBA, who remarked, "There are plenty of instances where the payrolls, under the individually hired day-labor method of highway building, increased excessively just before election." Expressing the viewpoint of labor, Lewis G. Hines, special representative of the American Federation of Labor, emphasized the fact that labor prefers to work for private owners rather than for the state or any of its sub-divisions.

No basic changes or shifts in existing highway policies and programs are contemplated as a result of the recent transfer of the Bureau of Public Roads to the Department of Commerce, Cornelius Vanderbilt Whitney, Under Secretary of Commerce, told the group at its closing-day luncheon. Though the department sees no reason for changing the private contract method of road building, he said, "This does not mean that the program is to be regarded as rigid. It must be flexible enough to adjust to changing national requirements. Any needs of a national defense nature, for instance, may have their effect upon the Bureau of Public Roads program."

Public Health Service to Have Engineering Division

CREATION OF A new engineering division in the Bureau of State Services of the U.S. Public Health has been announced by Federal Security Administrator Oscar R. Ewing. To be known as the Division of Engineering Resources, the new agency will centralize planning and development of Public Health Service programs in the field of sanitary engineering and environmental health. It will also consult with state and local health officials on the prevention and control of hazards arising out of the use of radiation-producing equipment and radioactive materials.

M. Allen Pond, assistant chief sanitary engineer of the Public Health Service, will head the new division

Moles Announce 1950 Construction Awards

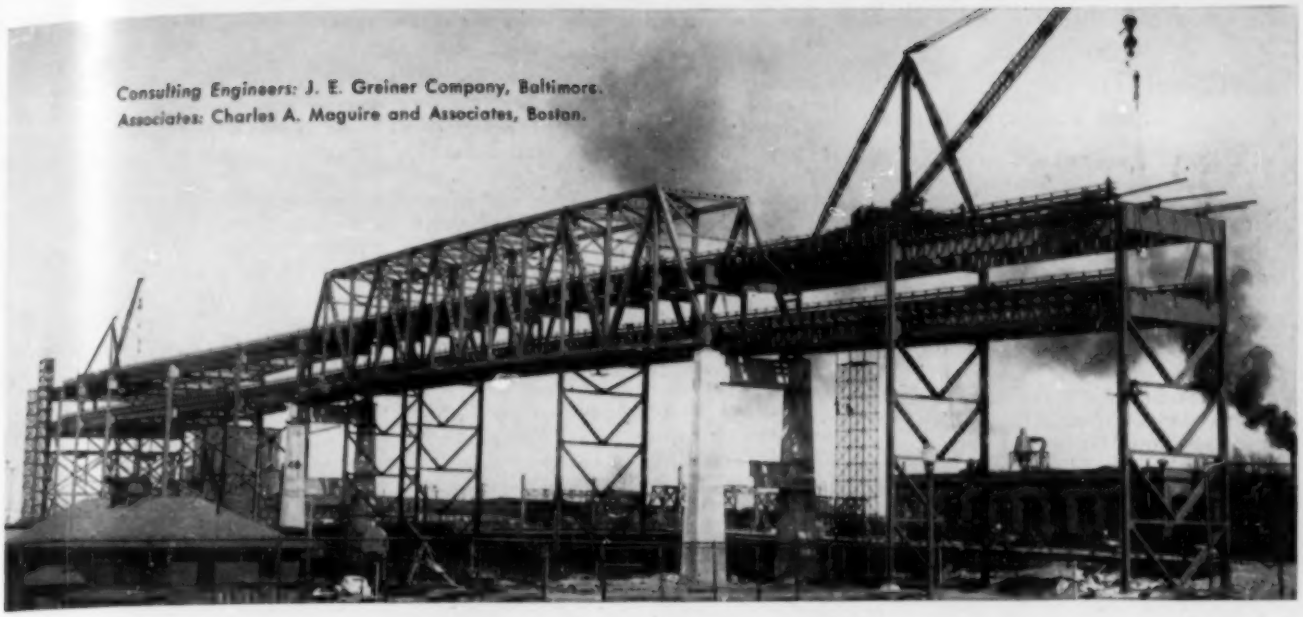
FORMER PRESIDENT HERBERT HOOVER, Hon. M. ASCE, and Richard E. Dougherty, Past-President ASCE and consultant to the New York Central System, have been selected as winners of the Moles' 1950 awards "for outstanding contribution to construction and for their exemplary careers as citizens." Presentation of the awards, consisting of bronze plaques and parchment

Herbert Hoover

R. E. Dougherty

citations, will be made at the Moles' tenth annual award dinner, to be held at the Waldorf-Astoria in New York on February 9.

Each year the Moles, New York society of tunnel and heavy construction men, honor one member and one non-member. For 1950, Mr. Hoover will be honored with the non-member award in recognition of his long career in public service, and in immediate recognition of "his priceless service as chairman of the Commission on Organization of the Executive Branch of the Government." Mr. Dougherty, the member recipient, will be honored for his notable work in railroad engineering and his professional services in such capacities as the presidency of the Society and of EJC. At present he is a member of the White House Renovation Commission.



Steel Double Decker in Boston's Inner Harbor

The Mystic River Bridge, connecting Charlestown and Chelsea, Mass., and becoming part of Boston's heavily-traveled Northeast Expressway, is to be the largest steel bridge ever built in New England. It is scheduled for completion early in 1950.

A viaduct more than two miles in length, the Mystic River Bridge will be 135 ft above high water, and will have two roadway levels, each accommodating three lanes of traffic. This double-decker bridge is to consist of a cantilever through-truss unit over the Mystic River, and a simple-span through-truss unit over the Little Mystic Channel. Its construction calls for some 31,000 tons of steel.

As fabricators and erectors of the truss span over the Little Mystic, as well as sections of the northern and southern approaches and toll plaza, Bethlehem is participating in the construction of this noteworthy addition to the Boston skyline.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation
Export Distributor: Bethlehem Steel Export Corporation

Fabricated Steel Construction

BETHLEHEM STEEL

Traveler derrick erects diagonal web member for Charlestown approach.

Guided by experienced hands, top chord is inched carefully into place.

Connecticut Dedicates Its First Vehicular Tunnel

A 1,200-FT TWIN-BORE tunnel beneath West Rock, Conn., Connecticut's first vehicular tunnel and last link in the 90-mile Wilbur Cross Parkway across the state of Connecticut, was officially opened to traffic on November 1 by Gov. Chester A. Bowles. Passing 200 ft under West Rock, the tile and concrete-lined tubes of the tunnel are separated by 26 ft of rock. The pavement lanes in each tube have a width of 23 ft. Cost of the tunnel was $2,000,000.

Completion of the tunnel, which was begun in 1948, gives Connecticut a continuous express highway extending diagonally across the state from Greenwich to Vernon, almost at the Massachusetts border. By-passing New Haven and other cities, the throughway will expedite traffic from New York to Boston.

New Lateral-Force Code Proposed at Joint Meeting

STRUCTURAL ENGINEERS, PARTICULARLY those in regions where earthquake shocks are not uncommon, continually review their design theories. A joint committee on lateral forces of the San Francisco Section of ASCE and the Structural Engineers Association of Northern California, of which John E. Rinne, M. ASCE, is chairman, previewed its proposed lateral force code before a joint meeting of the sponsoring organizations in San Francisco November 1.

According to Mr. Rinne, a distinct departure from the conventional "static" approach to lateral earthquake forces is the formulation of the lateral force coefficients in relation to the natural period of vibration of buildings and other structures. If V is the total lateral force, W the total weight of the structure, and C the coefficient, $V = CW$. The coefficient C, determined qualitatively from experiments and analyses on the reactions of simplified and idealized structures subject to earthquake motion, is established quantitatively by earthquake experience and engineering judgment by $C = 0.015/T$, where T is the period of vibration of the building.

Following the calculation of the total shear, V, the distribution of that shear vertically as applied forces on the structure is given by the formula:

$$F_x = \frac{Vw_xh_x}{\Sigma wh}$$

where

F_x is the applied earthquake force at level x
w_x is the weight at and tributary to level x
h_x is the height of level x above the base
Σwh is the summation of all wh for the structure

This formula is based on considerations of the dynamic deflections of structures under moment and shear resulting in a linear deflection curve, zero at the base and a maximum at the top.

The code is now being reviewed by the membership of the sponsoring societies, following which the committee will consider comments and prepare the final report for publication. The committee may publish a complete and formal report for professional discussion.

Other members of the committee are Arthur W. Anderson; John A. Blume, M. ASCE; Henry J. Degenkolb, Assoc. M. ASCE; Harold B. Hammill, M. ASCE; Edward M. Knapik, M. ASCE; Henry L. Marchand; Henry C. Powers; George Arthur Sedgwick, Assoc. M. ASCE; and Harold O. Sjoberg, Assoc. M. ASCE.

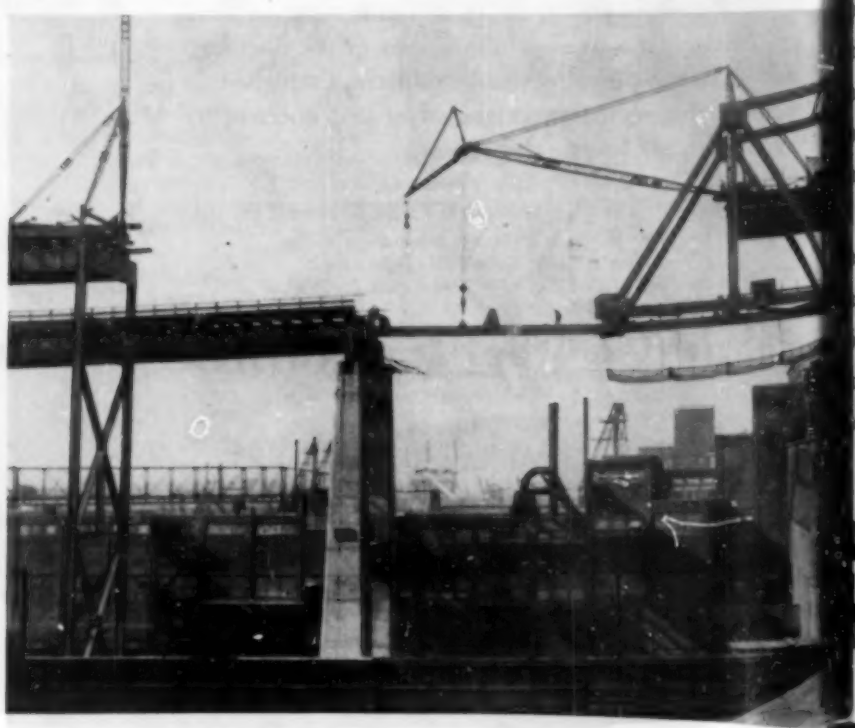
Work Starts on Western Extension of Turnpike

CONSTRUCTION OF THE western extension of the Pennsylvania Turnpike from Irwin to the Ohio border, was officially begun at recent ground-breaking ceremonies near Irwin. More than 10,000 persons in attendance heard a talk by Gov. James H. Duff and other celebrities and saw demonstrations of massive construction equipment to be used on the project.

The building and contracting company of D. W. Winkelman, M. ASCE, of Syracuse, N.Y., has been awarded the contract for the first section of the western extension. When completed in 1951, the turnpike from Philadelphia to the Ohio border will be 327 miles long.

Double-Deck Bridge Across Mystic River to Speed Boston Traffic

NEW $27,000,000 BRIDGE, under construction across Mystic River between Boston suburbs of Charlestown and Chelsea, will aid serious north-south traffic problem by replacing inadequate drawbridge (lower left structure in left-hand photo). In view at right, first workman starts across bridge after connecting link is placed. More than 50,000 tons of steel and 50,000 cu yd of concrete will go into new bridge, which has over-all length of 11,700 ft and 800-ft main span with vertical clearance of 135 ft. Double decks will reduce accident hazard by providing three lanes of traffic in each direction. Scheduled for completion in 1950, bridge will serve estimated 13,580,000 vehicles in its first year. Engineers were J. E. Greiner Co., of Baltimore, Md., and Charles A. Maguire & Associates, of Boston. Builder is American Bridge Co., U.S. Steel Corp. subsidiary, for Mystic Bridge Authority. Photos courtesy of U.S. Steel Corp.



Four steps to restore worn surfaces...FAST!

Asphalt resurfacing affords a rapid and economical means of providing any worn or broken pavement with a smooth-riding, easily maintained surface. For city streets or four-lane highways, the four steps outlined here describe one method of asphalt application that produces sound, long-wearing roads.

A Standard Oil Asphalt Representative can suggest other economical types of asphalt construction to meet your needs and local conditions. You are assured prompt delivery of Standard Oil Asphalt from any of the five large refineries located throughout the Midwest. Write Standard Oil Company (Indiana), 910 South Michigan Ave., Chicago 80, Ill.

STANDARD OIL ASPHALT

1 Spot Patching—Where the old highway is badly broken, holes are patched by filling with an asphalt-aggregate mix delivered hot from a central mixing plant.

2 Prime Coat—This is a thin coat of cut-back asphalt spread over both the old road surface and the patches that have been brushed clean. It helps to bind the asphalt to the old surface.

3 Binder Course—An asphalt-aggregate mix is delivered hot from the central mixing plant to an asphalt-finishing machine, and is laid from 2 to 3 inches deep over the old road surface and patches.

4 Wearing Course—This is the top course composed of asphalt, stone, and sand. It is mixed hot at the central mixing plant and laid by machine. This top course presents a smooth, waterproof, long-wearing surface which requires no seal coat or stone application.

STANDARD OIL COMPANY (INDIANA)

STANDARD

Field Test Breaks Prestressed Concrete Girder

GOOD CONCRETE, STEEL wire, and workmanship in the largest concrete girder to be tested to destruction at the Walnut Lane Bridge in Philadelphia's Fairmont Park so far surpassed design assumptions that several hundred engineers gathered to witness the test on October 25 were denied seeing the dramatic break. Next day the engineers in charge of the test shifted part of the 400 tons of ingots, which had been divided and applied at eight points along the girder to simulate a uniform load, toward the center of the span to produce compression rupture in the concrete of the top flange of the prestressed concrete girder.

Unique in the United States, the girder under test is a facsimile of each of the thirteen 160-ft I-shaped girders being cast by general contractor Henry W. Horst, Inc., to form the main span of the bridge carrying Walnut Lane over Lincoln Drive (CIVIL ENGINEERING, July, p. 32 and October, p. 35). Responsible for the adoption of the prestressed design for the City of Philadelphia were Thomas Buckley, M. ASCE, director of public works; A. Zane Hoffman, chief engineer; Samuel S. Baxter, M. ASCE, assistant chief engineer; and E. R. Schofield, M. ASCE, principal assistant engineer, now retired. The testing of the girder was under the direction of Prof. Gustave Magnel, M. ASCE, University of Ghent, who in association with the construction firm of Enterprises Blaton-Aubert of Brussels, developed the Magnel-Blaton prestressing system. Under the patents of the Brussels organization, Preload Enterprises, Inc., New York, designer of the prestressed superstructure, is the exclusive licensee in the United States. Preload Corp., New York, holds the subcontract under general contractor Horst for the prestressed superstructure of the bridge.

Designed for 5,400 psi, concrete cylinders taken from the mix poured in the girder on October 21, tested 7,200 psi at 28 days. Mechanical vibrators and the addition of $^3/_4$ lb of Plastiment per bag of cement facilitated the placing of 80 cu yd of concrete of low-water cement ratio concrete in the girder.

Ten days later each of four wire units, built up of sixty-four 0.276-in.-dia high-strength steel wires made by John A. Roebling's Sons Co., were drawn through rectangular holes cast in the lower flange and web of the girder. The wires were then stretched in pairs to 125,000 psi by a 10-ton hydraulic jack and attached to the ends of the beam by sandwich plates resting against bearing plates on the ends of the girder. The yield strength (0.2 percent permanent set) of the wire used tested 215,000 psi instead of the specified 170,000 psi; and the ultimate strength tested 242,000 psi instead of the specified 215,000 psi. The better-than-assumed strength of both the concrete and the steel wire contributed toward the ability of the test beam to carry a simulated live load two and a half times greater than the working live load for which it was designed before a crack appeared, and a load over ten times working load at final rupture.

Load was applied at eight points by hydraulic jacks operating between jacking frames on top of the girder to take a measured portion of a load of steel ingots hanging at ground level from the frames by threaded rods. When the limit of a jack's travel was reached the load was transferred and held on the lower I-beam of the frame with nuts on the rods while the upper I-beam was lowered to the retracted jack and held by nuts.

The Walnut Lane Bridge is designed for H-20-44 loading, with an additional impact of 17 percent. To the 150-ton dead load of the girder and testing frames, 20 tons were added to simulate the weight of the roadway deck and another 35 tons for the designed live load. Under this 205-ton load the deflection measured $1^1/_8$ in. When 35 tons more, double live load, were added to total 240 tons, deflection increased to $1^7/_8$ in. The first crack in the lower web concrete appeared at a total load of 262 tons when the deflection measured $2^7/_8$ in. When the load totaled 535 tons, over 10 times working load, many vertical cracks and a prominent horizontal crack were evident, and the deflection measured $15^1/_4$ in. At the moment of rupture the deflection had increased to $25^1/_2$ in.

The 13 abutting girders in the main span are 6 ft 7 in. deep, with a 7-in. web and a top flange 4 ft 3 in. wide, which when set side by side on the piers will be tied together transversely by prestressed wires. In the 74-ft side spans seven similar girders support a roadway slab.

PRESTRESS WIRE UNITS are drawn through the 160-ft Walnut Lane Bridge test girder, prior to prestressing, in lower left view. Simulated live load is applied to test girder by jacks lifting a measured portion of a hanging load of ingots (top photo). Note attachment of prestress wire units at end of girder and initial camber in girder. Dust flies at moment of rupture of concrete (lower right view) when deflection is $25^1/_2$ in. None of the wires broke. Photos by Windisch, courtesy of Preload Corp.

U.S. Loan Will Aid New Housing in Alaska

As a stimulus to construction of housing in Alaska, the Housing and Home Finance Agency is arranging for the loan of a $10,000,000 fund to the Alaska Housing Authority. This fund, authorized in the Alaska Housing Act and appropriated in the recently enacted Public Law 343, is in addition to FHA aids to private financing, which is currently being used to help relieve the acute shortage of both military and civilian housing existing throughout the territory.

Assistance to housing activities by means of the fund will be handled by the Alaska Housing Authority, under general supervision of the Housing and Home Finance Agency. The Alaska Housing Authority has offices in Anchorage, Fairbanks, and Juneau.

37 MILES OF VITRIFIED CLAY PIPE

HANDLES CORPUS CHRISTI POPULATION INCREASES

BELOW SEA LEVEL INSTALLATION

The project, designed and supervised by city engineers under the direction of H. H. Stirman, Public Works Director, and R. L. Otto, Head of the Engineering and Construction Division, drains and sewers Corpus Christi's Lindale Park development of 1200 new homes. It calls for 194,688 feet of Vitrified Clay Pipe ranging in size from 8 to 24 inches in diameter. Vitrified Clay Pipe was specified to resist corrosion from perpetually saturated and strongly electrolytic soil.

NO FOREIGN MATERIAL IN VITRIFIED CLAY PIPE

Vitrified Clay Pipe is not a compound or mixture of materials bonded by chemical agents. It is pure, natural clay fused at high temperatures by an exclusive process called *Vitrification*. Clay Pipe is a permanent, *heat-bonded* material that serves indefinitely without wearing out. Vitrification is the reason why Clay Pipe is acid-proof, rust-proof and cannot crumble or deteriorate.

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C-149-1

New Bladeless Centrifugal Trash Pump Promises Reduced Costs

A RECENTLY DEVELOPED bladeless centrifugal pump promises considerable reduction in the maintenance and operation of small sewage pumping stations. Developed and produced by Fairbanks-Morse and Co., the new pump is designed especially for those smaller communities which do not need (or want) a pump of high capacity. Discharging only about half the capacity of similar-sized standard trash pumps, the new pump requires a smaller motor in its operation, a bladeless pump designed to pass 3-in. solids, requiring only a 5-hp motor whereas a standard pump of similar size requires 7½ hp. The City of Monroe, Wis., reports that at a sewage pumping installation where a standard pump averaged at least one breakdown a week due to clogging, the new pump didn't clog at all during the first four months of operation.

The operating principle of the new pump is simple, a single helical path through the center of the impeller, replacing the blades, imparts the angular velocity to the fluid being pumped. The impeller, though unsymmetrical, is in dynamic balance through the addition of a counterweight.

In a recent test demonstration, conducted before several hundred members of the profession at the company's Beloit plant by Robert Blazebrook who is largely responsible for development, of the pump, unbelievably large pieces of cloth and canvas were passed by a pump designed to pass 3-in. solids. Among these were a pair of mens' trousers, and a technician's laboratory coat.

MATERIAL, successfully handled by 4-in. bladeless centrifugal trash pump developed and in production by Fairbanks-Morse & Co., ranges in size from small strips of cloth to large pieces of stiff canvas shown in photo.

Cooperation Is Keynote of Third Annual Virginia Highway Conference

MAN-MADE POLITICAL SUBDIVISIONS cannot be considered in planning a vigorous and practical state highway system, State Highway Commissioner James A. Anderson, M. ASCE, said in the opening address at the recent third annual Virginia Highway conference, to which Virginia Military Institute was host in Lexington. The mutual responsibility of state, highway, county, city, and village authorities in making the highway system serve all population groups efficiently and safely was stressed by Mr. Anderson.

In a leading talk on the interrelationship of railroads, airways, and highways in the transportation field, G. D. Brooke, M. ASCE, chairman of the Board of the Virginian Railroad, called for a "sound formula for the fairly apportioning all highway costs to the several classes of highway users," and said that if commercial aviation were "thrown upon its own resources," it would assume the position "in our national transportation to which it is economically adapted."

Lt. Gen. Leonard T. Gerow, commanding general of the Second Army, told the group that the nation's highway network has many shortcomings which, in time of war, "would seriously handicap military motor movements. Among these shortcomings, he listed "long narrow stretches with inadequate shoulders, sharp curves and steep grades, weak and narrow bridges, and lack of bypasses around large cities."

The purpose and methods of forest road construction in the two national forests of Virginia were discussed by K. W. Kennedy, Assoc. M. ASCE, assistant regional forester for the U.S. Forest Service. There are 2,400 miles of such roads in the state. Other speakers stressed the fact that, though engineering and enforcement activities cannot be neglected, much of the responsibility for highway safety rests with drivers and pedestrians. In the concluding address of the two-day program, A. T. Granger, M. ASCE, professor of civil engineering at the University of Tennessee, stressed the value of such coordinated conferences, stating that "The total effect of these meetings in improving highway transport in the United States in incalculable."

The conference was sponsored by the Virginia Department of Highways and the engineering department of VMI. Numerous state and local planning, building, and enforcement groups and equipment and road material concerns also participated. Attendance at the conference was approximately 650.

Advance Planning Loans Made Available to States

TO ENCOURAGE STATE and other non-federal agencies to maintain an adequate reserve shelf of fully planned public works, the General Services Administration will make allotments to the states from the initial $25,000,000 appropriation for the new advance planning program, according to an announcement from Jess Larson, Administrator of General Services. Mr. Larson also announced that a discretionary apportionment of $5,592,529 is being reserved for emergency use in areas where unemployment problems exist or threaten.

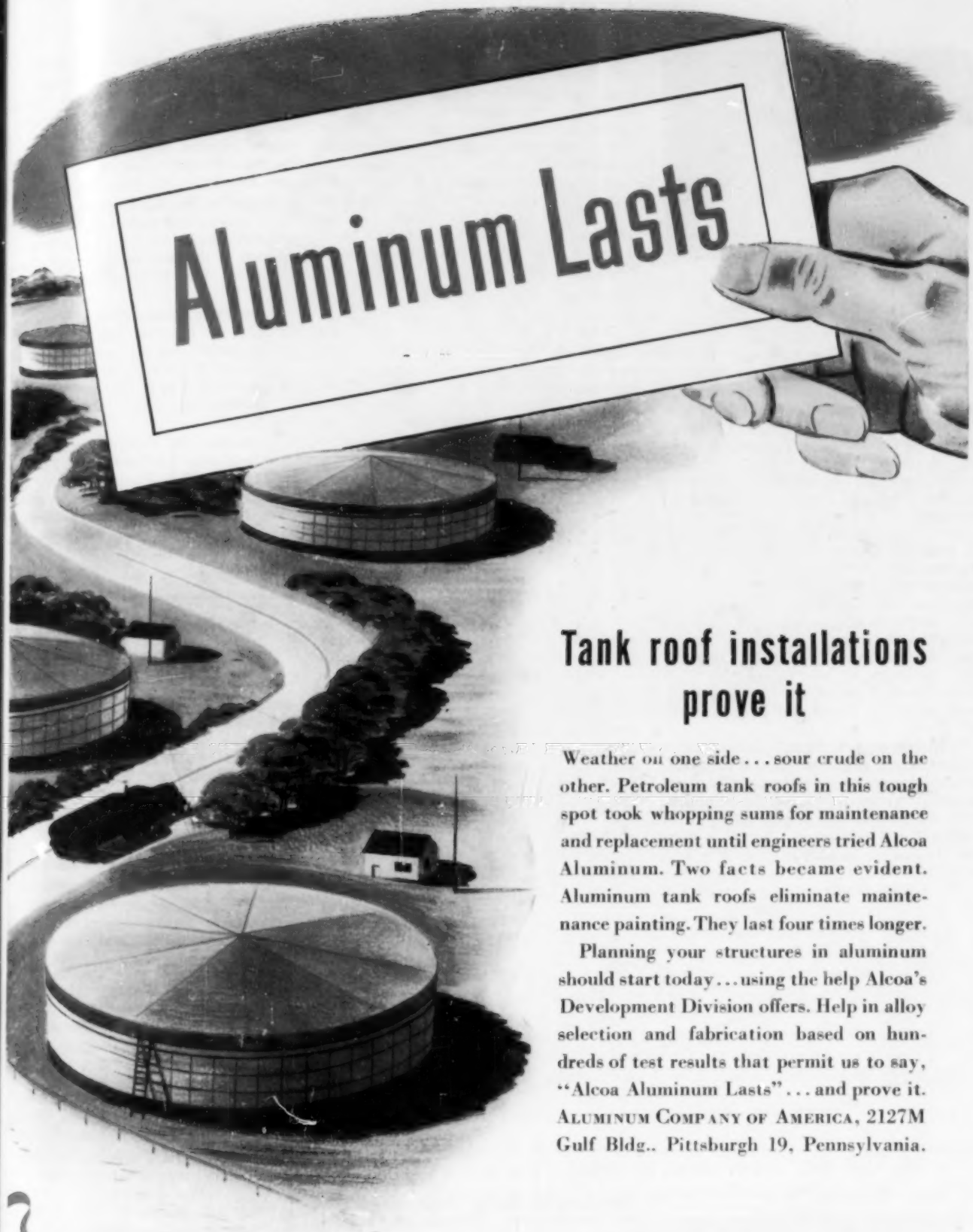
Congress recently reinstituted the advance planning program with an authorization of $100,000,000 for two years. Application forms and regulations to facilitate obtaining loans will be available shortly. Projects for which planning loans are sought must conform to an over-all state, local, or regional plan.

The present reserve shelf of non-federal public works has been estimated at about $2.5 billion, an amount below the annual rate for non-federal public construction which will run to $3.7 billion in 1949 and more than $4 billion in 1950.

Decrease in Construction Contract Employment Noted

EMPLOYMENT BY CONSTRUCTION contractors dropped slightly between mid-August and mid-September to a total of 2,315,000 workers, according to preliminary estimates of the Bureau of Labor Statistics of the Department of Labor. The first drop in contract construction employment since September, the decline marks the beginning of the usual seasonal slowdown. The September employment level of 23,000 was 1 percent below the revised estimate for August, and 2 percent under the figure for September 1948.

All parts of the country shared in the slight decline in employment except the New England, Middle Atlantic, and Mountain States, where construction contractors maintained their work forces practically at mid-August levels. About two-thirds of the over-all drop occurred in the East and West North Central regions.



Tank roof installations prove it

Weather on one side . . . sour crude on the other. Petroleum tank roofs in this tough spot took whopping sums for maintenance and replacement until engineers tried Alcoa Aluminum. Two facts became evident. Aluminum tank roofs eliminate maintenance painting. They last four times longer.

Planning your structures in aluminum should start today . . . using the help Alcoa's Development Division offers. Help in alloy selection and fabrication based on hundreds of test results that permit us to say, "Alcoa Aluminum Lasts" . . . and prove it. ALUMINUM COMPANY OF AMERICA, 2127M Gulf Bldg., Pittsburgh 19, Pennsylvania.

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ELECTRICAL CONDUCTORS · SCREW MACHINE PRODUCTS · FABRICATED PRODUCTS · FASTENERS · FOIL · ALUMINUM PIGMENTS · MAGNESIUM PRODUCTS

R. Robinson Rowe, M. ASCE

"I," SAID PROFESSOR Neare, "have a great deal of respect for surveyors. Modest braggarts all, and gentlemen with hairy ears, but precise in their approximations, like Al E. Dayde and just as stubborn. Al can hail a flagman at 700 yd, but I couldn't get him to say a word here about his problem of the two reference points for four streets, one being 250 ft from the four lines and the other 250 ft from the four intersections."

"And both driven deep," jibed Joe Kerr. "I tried the five equations for interscript quadrilaterals, but for $R = r = 250$ the eccentricity was imaginary. Of course the equations fit a plane figure, so I merely had to use solid geometry on Al's figure. For the inscript circle, $r = 70$, so Al set P 240 ft below its center to make it 250 ft from each line. Similarly, Q was driven 219.32 ft below the other center, and the eccentricity being 42.43 ft, I computed $PQ = 47.20$ ft."

"Just making it hard," drawled Ken Bridgewater. "The four lines of a quadrilateral intersect at six points, giving three quadrilateral combinations. Joe visualizes only the normal trapezium, ignoring the reentrant and star forms. For $R = r = 250$, the star can be interscript if $PQ = 250$, as in Fig. 1."

"In a way, Ken's right," conceded Cal Klater, "but what good would P and Q do Al? There are an infinite number of interscript star quadrilaterals that could be run out from those references. These can be constructed by taking for A any point on circle Q outside of circle P and drawing AB tangent to P intersecting Q at B. Then draw AD and BC tangent to P intersecting Q at D and C and CD will also be tangent to P.

"I give Al credit for being too smart to set ambiguous references. My answer is shown in Fig. 2, in which the two circles are exclusive and $PQ = 250\sqrt{2 + \sqrt{5}} = 514.54$."

"Well," decided the Professor, "I like all the solutions, even Joe's, since they all show ingenuity and the variety of interscriptability and quadrilaterals, but Cal did get the point that the problem was not a geometer's but a surveyor's.

"Now, not wanting to spoil the holidays for any of you, I have a potpourri of three ridiculously easy problems in arithmetic:

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...|.....|..8.      CASE    102564
  ..8               ACES         4
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  ....
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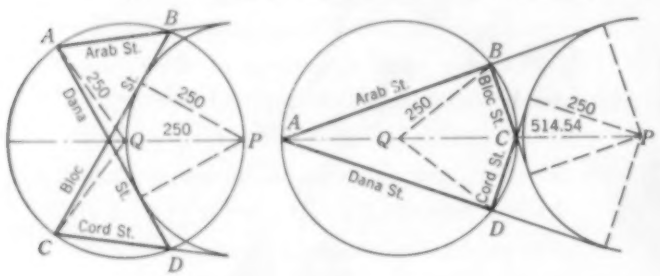
"The first is a problem in long division in which the 8's are shown and other digits have been replaced by dots; can you restore it? Next is an example of anagrammatic addition, as if a case of aces added to ASCE made the beginnings of science. Can you restore the addition by substituting a digit for each of the letters. The last is an illustration of simplified multiplication, in which a number can be multiplied by its unit digit by shifting that digit to the head end. Such numbers can be found for each of the digits 1,2, . . . 9; can you find the number for the digit 6?"

[Cal Klaters and Ken Bridgewaters indiscriminately were: Anne Othernut (J. Charles Rathbun), Richard Jenney, Stoop (John L.) Nagle, and Sourdough (Marvin A.) Larson.]



KEN SAYS it's an hourglass (Fig. 1, left), but Cal proves it's a kite (Fig. 2, right).

Meetings and Conferenees

American Association for the Advancement of Science. All branches of science will be represented at the 116th meeting of the American Association for the Advancement of Science, in New York City, December 26–31.

Associated Equipment Distributors. Headquarters for the annual meeting of the Associated Equipment Distributors will be the Stevens Hotel, Chicago, Ill., January 15–19.

Illinois Traffic Engineering Conference. The second Illinois Traffic Engineering Conference—sponsored by the Illinois Division of Highways, the Midwest Section of the Institute of Traffic Engineers, and the University of Illinois Engineering College—will take place at the University of Illinois, December 6–8.

National Research Council. The annual meeting of the Highway Research Board of the National Research Council is scheduled for the National Academy of Sciences and the National Research Council Building, Washington, D. C., December 13–16. Inquiries should be addressed to Roy W. Crum, Director, Highway Research Board, National Research Council, 2101 Constitution Avenue, N.W., Washington 25, D.C.

Society of Plastics Engineers, Inc. New developments and techniques in the plastics industry will be discussed at the 1950 convention of the national Society of Plastics Engineers, Inc., in Cleveland, Ohio, January 11–13.

Plant Maintenance Show. Jointly sponsored by the American Society of Mechanical Engineers and the Society for the Advancement of Management, the first Plant Maintenance is to be held in the Cleveland Auditorium, Cleveland, Ohio, January 16 through 19.

Southwest Air Conditioning Exposition. The Southwest Air Conditioning Exposition will take place at Fair Park, Dallas, Tex., January 23–27, in conjunction with the 56th annual meeting of the American Society of Heating and Ventilating Engineers, sponsors of the exposition.

Positions Announced

Detroit Civil Service Commission. The Detroit Civil Service Commission announces daily examinations up to February 1, 1950 for the positions of Junior, Intermediate, and Senior City Planner at salary ranges of $3,298 to $3,749; $4,067 to $4,544; and $4,939 to $6,134, respectively. Resident requirements have been waived. For detailed information address, Detroit Civil Service Commission, 735 Randolph St., Detroit 26, Mich.

Glendale, Calif. The City of Glendale, Calif., is inviting applications for the position of general manager and chief engineer of the Municiapl Water, Power, and Light Department at a salary of $12,600 a year. Only graduates in civil, electrical, or mechanical engineering, with at least ten years' administrative experience in utility work, will be considered. Qualifications will be considered carefully, and an immediate permanent appointment will be made. Inquiries and biographical data should be sent to the City Manager's Office (attention T. L. Sharp), 613 East Broadway, Glendale, Calif., before January 15, 1950.

U.S. Civil Service Commission. Applications for positions as highway engineer and highway bridge engineer, at Grades P-3 through P-4, will be accepted by the U.S. Civil Service Commission until further notice. Salaries range from $3,727 to $5,232 a year. Since "the duties of these positions require moderate to arduous physical exertion involving rotating assignments, indoors and outdoors, in various parts of the country," a physical examination of candidates will be made by a federal medical officer before appointment. Information may be obtained from the U.S. Civil Service Commission, Washington 25, D.C., or from any regional office.

Take a look at what's behind every Gurley Transit

From first castings to final calibration—every step in the manufacture of Gurley transits is focused on accuracy—both in the production of each individual part and their combined performance in the field. That's why—

Spirit levels are reversion type—ground to barrel shape in Gurley-designed machines for sensitive, accurate performance without distortion. Graduations are precisely matched and etched on opposite sides. Vials are truly circular at any cross-section—assure identical reverse readings.

Gurley transits are durable—but lightweight, too. They won't distort with age. Parts are heat-treated, hardened and tempered as required. Special bearing metals are cast integral with sturdy parts and can't shake loose. They're aluminum for easy carrying, anodized and dyed to prevent corrosion and tarnishing.

Collimating methods which duplicate first order outdoor observing programs without weather uncertainties are used to calibrate assembled Gurley transits. These facilities are equivalent to those used by the U. S. Coast and Geodetic Survey. Here *"20 second" transits are calibrated to approximately one second.*

Gurley telescopes reach maximum optical power. All lenses are Gurley-made in our completely equipped optical department, tested under helium light for conformity to a master test plate. They're coated, too, if desired, in the latest-type lens coating machines.

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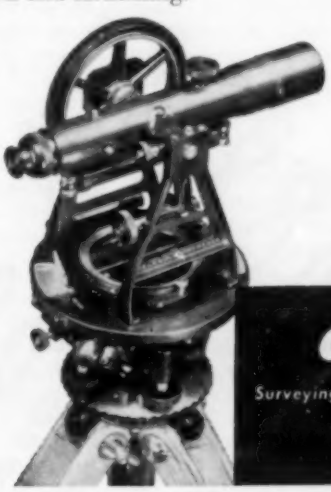
For complete details, write for Bulletin 50.



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NEW IN Education

A HALF-TIME RESEARCH assistantship, paying about $112 a month and sponsored by the National Advisory Committee for Aeronautics, is available in the Department of Engineering Mechanics at the Pennsylvania State College, starting February 1, 1950. The work deals with the experimental and theoretical study of behavior of metals subjected to combined stresses in the plastic range. The research work could be used for a master's or doctor's thesis in engineering mechanics. Those interested should write to Prof. Joseph Marin, Department of Engineering Mechanics, Pennsylvania State College, State College, Pa.

PURCHASE OF A Sheffield Farms Building as the first step in a proposed $12,000,000 program for the Columbia University School of Engineering has been approved by the university trustees and Development Planning Committee. The long-term objective of the program includes construction of a six-story laboratory building at a cost of $5,000,000 as the main unit of the research center and an additional minimum endowment of $7,000,000 for physical operation, research fellowships, scholarships, and basic engineering program. The reason for the contemplated expansion, according to Dean James K. Finch, M. ASCE, is the growth of the School of Engineering in recent years. At present eight different buildings on the campus are being utilized by the School, and space demands have constantly increased.

NEWS OF Engineers

C. G. Levander, since 1933 assistant director of public works for Austin, Tex., has been named director.

Roy B. Williams, who recently retired as assistant district manager of the Bureau of Reclamation's Columbia River District at Coulee Dam, Wash., after 37 years of service, has been awarded the Department of Interior Gold Medal and Distinguished Service Certificate for "superior contributions to the advancement of the Nation's vast multipurpose water conservation program in the West."

Roy B. Williams

ASCE Past-President R. E. Dougherty, advisory consultant to the New York Central Railroad, is the recipient of the Townsend Harris Medal, which is awarded annually to prominent City College alumni for outstanding postgraduate achievement in "some significant field of human endeavor." Presentation of the medal was made recently during ceremonies held in the Astor Hotel in New York City.

Fenner H. Whitley, of St. Petersburg, Fla., has been appointed sanitary engineer of the 8th Army Medical Section with headquarters in Yokohoma, Japan. Colonel Whitley's duties will be to inspect water supply facilities and recommend changes and improvements. During World War II Colonel Whitley served with the Military Government in Berlin as a consultant to German Public Health officials.

P. Y. K. Howatt, president of the Howatt Concrete Co., Inc., Chevy Chase, Md., was recently installed as new president of the Washington Building Congress at the annual meeting of the organization in the Mayflower Hotel.

Henry F. Vaughan, dean of the University of Michigan's School of Public Health, was presented the Sedgwick Memorial Medal of the American Public Health Association during the organization's recent annual meeting in New York. Dr. Vaughan was cited for "distinguished service in public health" in his work at the University, where since 1941 he has brought the school of public health to front rank among institutions of graduate public health study and training.

Henry F. Vaughan

Robert P. Kline has assumed new duties as district engineer of the Panama District of the Corps of Engineers. Joining the Engineer Corps in 1938, Colonel Kline has been in the Pittsburgh, Baltimore, and Buffalo Districts, and the Antilles Area office of Puerto Rico.

Dwight F. Johns, colonel, Army Corps of Engineers, and division engineer of the South Pacific Division at Oakland, Calif., will retire December 31. Previously Colonel Johns served as assistant chief of engineers for military operations in Washington, D.C. For his service during World War II in the Southwest Pacific Theater he received many awards, including the American Distinguished Service Medal. He will retire from the Corps with the rank of brigadier general.

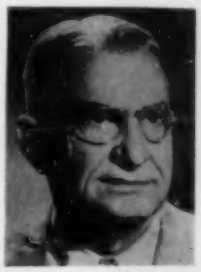
James Gordon Clark, until recently associate professor of civil engineering at the University of Illinois, has been advanced to the rank of professor. Professor Clark has been teaching both graduate and undergraduate courses.

C. O. Dohrenwend, formerly assistant director of the Midwest Research Institute, has accepted the appointment of head of the applied mechanics department at Rensselaer Polytechnic Institute, Troy, N.Y. Dr. Dohrenwend joined the staff of the Midwest Research Institute in 1946 as research consultant.

Miles D. Catton, since 1941 manager of the Portland Cement Association's Soil-Cement Bureau, has been appointed director of development, in which capacity he will head the organization's work toward development of new products and processes, and to new and improved uses of portland cement. Mr. Catton has been with the Association for the past 23 years.

Lee G. Warren, Chattanooga, Tenn., consultant, is now located at 421 Poplar Street.

L. C. Urquhart, colonel, Corps of Engineers (Ret.), has become associated with O. J. Porter & Co., consultants, as assistant chief engineer in charge of the firm's eastern offices in Newark, N.J. and New York City. Colonel Urquhart served as wartime chief of the engineering division in the Office of the Chief of Engineers and acted in a similar capacity in 1946 in the Honolulu office. Before entering the Army in 1941, he was professor and head of the structural engineering department at Cornell University.



Col. L. C. Urquhart

David E. Donley recently resigned from the Cornell University faculty, where he was head of the hydraulic engineering department, to accept a position as hydraulic engineer in the regional office of the Bureau of Reclamation at Boise, Idaho. Mr. Donley will be connected with the Project Planning Branch of the Hydrology Division that is studying flood conditions of the Columbia River Basin.

Marvin E. Ray is now city supervisor at Pullman, Wash. Previously, Mr. Ray was city engineer for Vancouver, where he supervised construction of several of the city's large sanitary engineering projects.

ASCE members recently elected to office by the Dallas Technical Club are **John E. Sergeant,** president, and **Richard L. Powell,** director.

John S. Cotton, consulting engineer of San Anselmo, Calif., has been engaged by the State of Israel to prepare a master plan and design for the irrigation and power development of Israel. The plan involves conducting the waters of the Jordan River from the northern boundary to the southern end of the country for irrigation, and bringing Mediterranean Sea water to the Dead Sea for the generation of power.

E. V. Spence, of Austin, Tex., formerly chairman of the Texas Board of Water Engineers, was recently appointed to the Interstate Compact Commission for Texas on the Canadian, Red, and Sabin rivers.

Alfred Machis has been named director of the Department of Public Works in Anne Arundel County, Maryland. Mr. Machis served as a lieutenant in the Army Engineer Corps during the second World War. Since then, he has been employed by the Maryland State Planning Commission and the Washington Suburban Sanitary Commission.

(*Continued on page 84*)

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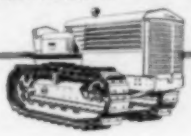

"THE SIGN OF EXTRA SERVICE"

(*Continued from page 82*)

Lowell J. Stephenson, commander, CEC, USNR, has joined the staff of O. J. Porter & Co., consulting engineers, with headquarters in Newark, N. J. Commander Stephenson, recently released to inactive duty from the San Francisco Naval Shipyard, has been contract superintendent and projects manager of heavy construction engineering projects for the past 3½ years. Commander Stephenson will act as construction engineer for the O. J. Porter Co. in its work as joint consultant on stabilization, grading, and paving of Sections 6 and 7 of the New Jersey Turnpike for the Turnpike Authority.

L. J. Stephenson

Alfred Hedefine, with the New York consulting firm of Parsons, Brinckerhoff, Hall & Macdonald, has been elected president of the newly organized Rutgers Engineering Society, a group of alumni of the engineering school of Rutgers University.

David H. Harker, secretary of the Indiana Drainage Association, Inc., Centerton, has been appointed county surveyor of Morgan County (Indiana).

J. N. Wallace, president of the West Virginia Section of ASCE, has been named engineer responsible for the work of the District 6 office of the West Virginia Road Commission, at Moundsville. Mr. Wallace previously served as the Koppers Company's West Virginia representative.

C. Martin Riedel recently resigned as engineer of waterworks design for the Bureau of Engineering of Chicago, Ill., after 23 years' service, to join the firm of Chemical Soil Solidification Co., as a senior partner.

M. C. Blanchard, chief engineer for the Sante Fe Railway's Coast Lines with headquarters in Los Angeles, Calif., has retired after 47 years of service. Mr. Blanchard entered the employ of the railway upon graduation from the University of Kansas in 1902.

A. P. Hancock, for several years city manager of Amarillo, Tex., has been named city manager of Port Arthur.

A. Amirikian, head engineer, Bureau of Yards and Docks, Navy Department, Washington, D.C., was awarded the 1949 Lincoln Gold Medal by the American Welding Society at the recent annual meeting of the society in Cleveland. The honor was conferred on Mr. Amirikian for his paper entitled "Future Developments in Welded Steel Buildings," published in the August 1948 issue of *The Welding Journal*.

ASCE members affected by recent reorganization of the Montana State Highway Department include, **Ray Percy,** maintenance engineer, Helena; **Fred Zuinnell,** district engineer at Butte for the Butte-Bozeman Division; **Jack McGhee,** district engineer for the Lewiston-Billings Division; and **Cliff Thompson,** reconnaissance engineer in charge of the preconstruction stage of highway work, at Helena.

William E. Hiatt, former regional engineer of the Chicago, Ill., office of the U.S. Weather Bureau, has been transferred to Washington, D.C., where he will assume new duties as area engineer for the Eastern Area, including the Ohio River Basin and the North and Middle Atlantic States.

J. A. Leadabrand has been promoted to manager of the Soil-Cement Bureau of the Portland Cement Association. On the association's staff since 1936, Mr. Leadabrand has worked in development and laboratory work on soils and soil-cement mixtures, except for a short period during World War II.

J. B. Rutter, who recently retired as vice-president of Monsanto Chemical Co. and general manager of its Merrimac Division, will be retained by the organization as an industrial consultant. Mr. Rutter plans to open offices in Boston after January 1. While with the Monsanto Co., Mr. Rutter played a prominent part in developing its position in the synthetic rubber program.

Spencer V. Cortelyou, assistant state highway engineer for the California Division of Highways in charge of District VII, including the metropolitan area of Los Angeles, has retired after 38 years of service. Prior to entering the Divison of Highways as principal assistant division engineer of District VII, Mr. Cortelyou had been chief of a survey party with the Los Angeles County Road Department, and earlier was with the Insular Department of Public Works of the Philippines. Mr. Cortelyou has played a vital part in the planning and construction of many major arteries of travel in California.

B. J. Fletcher has been named assistant chief hydraulic engineer of the Aluminum Company of America. Active in work on military applications for aluminum and on the atom bomb project during the recent war, Mr. Fletcher received a meritorious citation from the government for this work in connection with the bomb. He has been with the Aluminum Company of America for 23 years.

Ronald F. Scott, former regional director of the State Planning Commission of Tennessee, has been made director of the city Planning Department at Greensboro, N.C. Prior to joining the commission, Mr. Scott served as planning engineer for Superior, Wis.

A. T. Waidelich has been elected vice-president in charge of research for the Austin Co., Cleveland, Ohio. In this capacity, Mr. Waidelich will supervise the company's volume of plant location surveys and economic and engineering reports, as well as its independent research projects. Since 1941 Mr. Waidelich has been assistant director of research at the Cleveland headquarters. He is credited with major responsibility for development of the H-section welded truss, and has directed surveys involving the investment of more than $50,000,000.

A. T. Waidelich

H. Ray Kingsley recently retired from active civil engineering practice after a career of 46 years and will make his home in Chicago, Ill. Mr. Kingsley has been connected with the American Bridge Co.; D. H. Burnham, architect; the Fuller Construction Co., in Tokyo, Japan; the Defense Plant Corp., and other organizations.

D. B. Steinman, New York consultant and authority on the design and construction of bridges, has been elected a City College of New York chapter honorary member of Chi Epsilon, national honorary civil engineering fraternity. Elected from the faculty at the same time were **J. Charles Rathbun,** retired professor of civil engineering at C.C.N.Y.; **William Allan,** dean of engineering; and **Walter Willig,** head of civil engineering department.

Edward J. McGrew, Jr., former commissioner of public works of New York City, has been appointed chairman of the State Building Code Commission, created by the legislature to devise new standards of construction in the State. The Commission is empowered to adopt rules and regulations relating to the construction of all buildings, the installation of equipment therein, the standards or requirements for materials to be used, and provision for safety and sanitation.

Deceased

Lewis James Addicott (M. '35) retired engineering educator, died at his home in Athens, Ohio, on October 30, at the age of 81. A graduate of the Case Institute of Technology in 1904, Professor Addicott went in that year to Ohio University at Athens to found and head the department of civil engineering. He retired from the post in 1938. In addition to his teaching duties, Professor Addicott also served for some years as supervising architect for the university, directing construction of the library, the gymnasium, an auditorium, and several other buildings on the campus. Active in civic affairs, he had been a member of the Athens City Council and member and clerk of the Athens Board of Education.

Charles Louis Bates Anderson (Assoc. M. '08) a retired lieutenant commander in the Navy Civil Engineer' Corps, died in the Naval Hospital, Mare Island, Vallejo, Calif. on September 29. He was 73. A graduate of the Massachusetts Institute of Technology in 1901, Mr. Anderson spent his early career in municipal engineering work for a number of cities and towns. These included Newburyport, Mass., Pittsburgh, Pa., Atlanta, Ga., Natchez, Miss., and Wilson, N.C. As a public works officer in the Navy for many years prior to his retirement, he had been stationed in New York, San Francisco, Yorktown, Va., and other cities.

John Edward Bebb (Assoc. M. '13) assistant engineer of structures for the New York

(*Continued on page 86*)

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FROM whatever standpoint you examine the qualities of concrete pipe for water lines—cost, efficiency, maintenance expense or length of service—concrete pipe is the best buy. Here's why:

1. It can be designed for all pressures used in American water works practice
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These advantages were obtained in a new water supply line in Provo, Utah, shown above, where more than 3¼ miles of 48" concrete pipe were used. The Utah-Idaho Concrete Pipe Company of Salt Lake City was the contractor.

Whether you are planning a water line like the Provo project or a small community or industrial job, it pays to examine all the advantages of concrete pipe. Its first cost is moderate, its upkeep is little or nothing and it has extra long life.

Taken together these three important factors give you *low-annual-cost* service. That is the true measure of economy in water line operation.

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(*Continued from page 84*)

Central System at Detroit, died at his home in Birmingham, Mich., on October 7. He was 66. Mr. Bebb was with the Michigan Central Railroad from the time of his graduation from the University of Cincinnati in 1905 until 1939, holding the successive positions of draftsman, office engineer, assistant bridge engineer, and bridge engineer. He was assistant engineer of structures for the New York Central System from 1939 on.

Henry Morton Brinckerhoff (M. '40) member of the New York City consulting firm of Parsons, Brinckerhoff, Hogan & Macdonald and its predecessor firms since 1906, died at his home in Englewood, N.J., on October 12, at the age of 81. A transportation expert, Mr. Brinckerhoff was connected with the construction of the I.R.T. subway in New York City, the Detroit-Windsor Tunnel, and the elevated systems of Brooklyn and Chicago. He also served as consultant for the City of Chicago in planning its subway, and was consultant on construction of the New York World's Fair. He was first chairman of the Englewood city planning board established to meet the problems caused by construction of the George Washington Bridge. More recently he was one of three engineers appointed by Governor Dewey on plans for the proposed Buffalo-to-New York throughway. Mr. Brinckerhoff held patents on the third rail system and many other railway devices, and was author of numerous technical papers.

H. M. Brinckerhoff

Cecil Sidney Camp (M. '47) director of the school of hydraulic engineering at Louisiana State University, was killed in an automobile accident together with his wife and two sons, near Clayton, La., on October 16. He was 42. A graduate of the University of Arkansas, with an advanced degree from the University of Iowa, Professor Camp had taught at Mississippi State College, Syracuse University, and Oregon State College, and been in the South Atlantic district office of the Corps of Engineers. He was on the staff of the Tennessee Valley Authority at various times from 1935 to 1941, and from the latter year to 1948 served as professor of hydraulic and sanitary engineering work at the University of Tennessee. He had headed the school of hydraulic engineering at Louisiana State for the past year. Professor Camp was a member of Tau Beta Pi, and author of numerous engineering publications.

Francis Eugene Mitchell (Assoc. M. '47) of Fayetteville, Ark., died in the same motor crash that took the life of Cecil S. Camp, M. ASCE, and his family, near Clayton, La., on October 16. He was 33 years old and an alumnus of the University of Texas, from which he received the B.S. degree in chemical engineering in 1941. An associate professor of chemistry at the University of Arkansas since 1946, Mr. Mitchell was on leave of absence from the university doing graduate work at Louisiana State University. During the war he served as an officer in the Navy Civil Engineer Corps.

Charles Cohen (Assoc. M. '07) retired engineer of New York City, died suddenly in a hospital in the Bronx on October 25, at the age of 70. Prior to his retirement twelve years ago, Mr. Cohen had been a member of the engineering firm of Cohen & Ehrard, and for a time was associated with the real estate firm of Joseph P. Day, Inc.

Burt Cole (Assoc. M. '01) retired engineer of Santa Monica, Calif., died suddenly there on September 26, at the age of 79. A graduate of the Colorado School of Mines, class of 1892, Mr. Cole had early experience in coal and iron mining engineering and in field work for the U.S. Geological Survey. For some years he was chief engineer and manager of the Palmdale (Calif.) Water Co. and the Palmdale Irrigation District. He had also been resident engineer for the Los Angeles County Flood Control District on the construction of Big Dalton and Thompson Creek dams.

Emil Diebitsch (M. '02) chairman of the Sirian & Contact Co., Newark, N. J., died at his home in Nutley, N.J., on September 22. Mr. Diebitsch, who was 83, was for many years vice-president of the John Pierce Foundation & Contracting Co., New York. Later he was president and treasurer of his own contracting company, Emil Diebitsch, Inc. He was a civil engineering graduate of Lehigh University, class of 1889.

Arthur L. Enger (M. '47) structural engineer in the Division of Architecture of the California Department of Public Works, Sacramento, died at his home there on September 5. He was 63. A graduate of the University of Illinois, class of 1911, Mr. Enger had been assistant irrigation engineer at the Agricultural Experiment Station of the University of Arizona; supervising architect for the El Paso, Tex., Board of Education; and structural engineer in the Los Angeles City Building and City Bridge Departments. Since 1933 he had been connected with the School Section of the Division of Architecture in Los Angeles and Sacramento, except for a period of war work in the early forties. During World War I he was a captain in the army, and remained active in the reserves until 1940.

Charles Earl Fauber (Jun. '43) of Montrose, Colo., was killed in an automobile accident in November 1948, according to word just received at Society headquarters. Mr. Fauber was 26 and a graduate of the University of Colorado, from which he received the degree of B.S. in C.E. in 1943. Mr. Fauber had been a rodman for the Broderick & Gordon Construction Co., in charge of a maintenance crew at the Denver Ordnance Plant, and for several years during the war was an ensign in the Navy Civil Engineer Corps.

Harold Clarkson Foy (Assoc. M. '42) manager of the Brown County (Texas) Water Improvement District No. 1, died at his home in Brownswood on August 24. He was 41. Mr. Foy was for many years with the Texas State Highway Department, and more recently had been employed on the construction of the Corpus Christi Naval Air Station and as post and maintenance engineer at Camp Bowie. He became connected with the Brown County Water Improvement District in August 1948.

Robert Newton Gillespie (Assoc. M. '41) chief engineer of the Cement Gun Co., Inc., Allentown, Pa., died at his home there on October 22. Mr. Gillespie, who was 45, had been with the Cement Gun Co. since 1924. He had served the company as resident engineer on a large contract in connection with construction of the Holland Tunnel; Chicago district engineer; New York district engineer; construction manager on the building of the Outer Drive Bridge in Chicago; and construction manager of the huge Raymondville, Tex., irrigation project. Interested in civic affairs, Mr. Gillespie took a prominent part in developing the Lehigh Boy Scout Council and other Scout work.

Frederick Nickerson Grant (Assoc. M. '31) of San Diego, Calif., died recently at the age of 61. Mr. Grant spent many years in the Arizona Highway Department, which he served as resident engineer, district maintenance engineer, district engineer, and deputy state highway engineer. He was a veteran of the first World War and a graduate of the University of Georgia, class of 1908.

Frederick May Green (Assoc. M. '04) retired engineer of Calistoga, Calif., died in San Francisco on August 8, at the age of 77. After a number of years teaching and practicing structural engineering in the East, Mr. Green went to California in 1917 with the Moore Shipbuilding Co., Oakland. Later he held positions with the Standard Oil Co. and the Southern Pacific Co., and from 1924 until his retirement in 1942 he was senior structural engineer in the State Division of Architecture. He had been living in Calistoga since his retirement.

William Nelson Hazen (M. '09) retired engineer of West Orange, N.J., died in Orange, N.J., on September 13. His age was 80. A graduate of Dartmouth College, class 1888, Mr. Hazen was at one time a partner in the former Baltimore engineer firm of Fank & Hazen. He was assistant engineer of the New York Central Railroad for 25 years prior to his retirement ten years ago.

Charles Henry Hurley (M. '30) retired engineer of Albany, N.Y., died on October 2, at the age of 67. A graduate of Rensselaer Polytechnic Institute, class of 1908, Mr. Hurley spent most of his career in various engineering departments of New York State, including the Water Supply Commission, the Highway Department, and the Conservation Commission. He was with the Hudson River Regulating District for eleven years, in charge of all field work in connection with the construction of the Sacandaga Reservoir.

Duncan Thomas Memory (Assoc. M. '36) with the Rail Transportation Works of the Tennessee Coal, Iron & Railroad Co., Birmingham, Ala., died on August 5. He was 51. A graduate of North Carolina State College, class of 1923, Mr. Memory had been assistant division engineer for the

(*Continued on page 88*)

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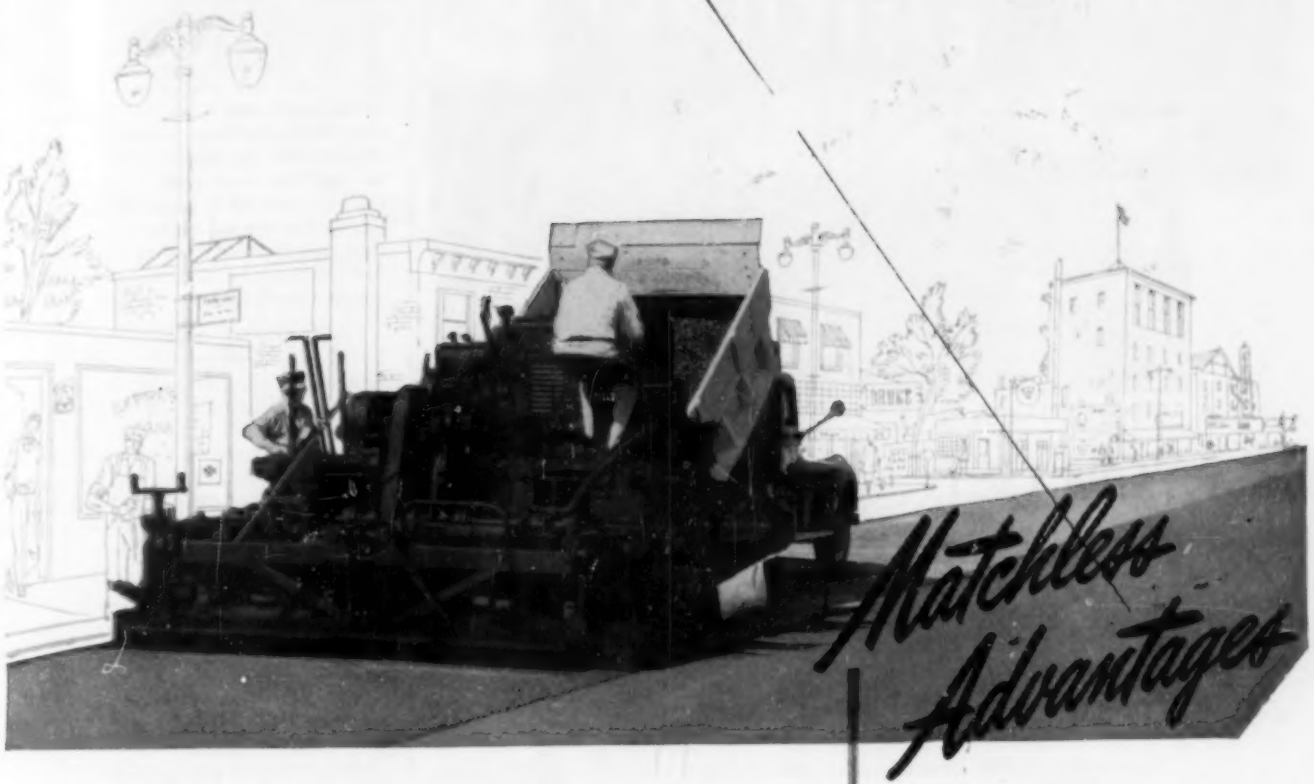

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(*Continued from page 86*)

Seaboard Airline Railway Co., at Norfolk, Va.; resident engineer for the Cincinnati Union Terminal Co.; and designer and office engineer for the Tennessee Valley Authority at Knoxville, Tenn., in charge of the relocation and construction of $1,000,000 railroad project.

Raymond Wilcox Pierce (Assoc. M. '45) an engineer in the Division Engineer's Office, South Atlantic Division, Corps of Engineers, Atlanta, Ga., died in a hospital there on September 22. He was 30 years old, and held bachelor's and master's degrees in civil engineering at the University of Michigan. Mr. Pierce spent much of his career with the Corps of Engineers, and had been connected with projects in Ohio, Maine, and the South. For a short time he also did work with the Federal Power Commission in Chicago, and the U.S. Forest Service in Philadelphia. Active in the Georgia Section, at the time of his death, Mr. Pierce was secretary-treasurer of the Georgia Section.

Louis Edward Salch (Jun. '38) of St. Louis, Mo., died recently at the age of 34. Following his graduation from the University of Illinois in 1938, Mr. Salch became connected with the Illinois State Highway Department at Danville. From 1940 until recently he was in the Navy Department at the Philadelphia Navy Yard, successively as junior, assistant, and associate naval architect.

Donald Irving Seymour (Assoc. M. '23) of the Right of Way Department of the Standard Oil Company of California, Los Angeles, died on September 18. Mr. Seymour, who was 57, had been with the Standard Oil Co. since 1920. Earlier he was connected with the Pacific Gas & Electric Co., in San Francisco. He was a graduate of Stanford University, class of 1915.

James Edwin Garrett (M. '05) of Paragould, Ark., died recently at the age of 87. A graduate of the University of Missouri in 1886, Mr. Garrett spent many years on railroad location and construction in the West and on railroad construction and mining in Mexico.

Isaac Farber Stern (M. '08) for many years a consulting engineer in Chicago, Ill., died on September 10. His age was 77. A graduate of the University of Michigan, class of 1895, Mr. Stern was at one time bridge engineer for the Chicago & Northwestern Railway, and in the recent war he served as consultant to the Navy on raising bridges in the Chicago area to permit the passage of large naval vessels from the Great Lakes to the Gulf of Mexico by means of the inland waterway. For a number of years Mr. Stern was a member of the Illinois State Board of Examiners for Structural Engineers.

George Whitfield Sykes (Assoc. M. '97) consulting engineer of Mercer, Pa., died there in 1947, according to information just received at Society headquarters. He was 79. Mr. Sykes was for a number of years chief engineer of the Pittsburgh, Shenango & Lake Erie Railroad Co. (now the Bessemer & Lake Erie Railroad), with headquarters at Greenville, Pa. Later he was engaged in the oil business in Texas, returning to Mercer after his retirement.

New Publications

Research. Investigations in the physical sciences carried on at the National Bureau of Standards during 1948 are summarized in the 1948 Annual Report of the Bureau. Research on housing problems, particularly the problem of applying engineering principles to structural design, is one of the subjects given emphasis in the 272-page illustrated publication. The report is for sale by the Superintendent of Documents, Government Printing Office, Washington 25, D.C., at 25 cents a copy.

Tunnels, Fire Hazards. A report on the recent Holland Tunnel chemical fire has been prepared for the Port of New York Authority by the National Board of Fire Underwriters. The primary purpose of the 18-page illustrated report is to record the sequence of events leading up to and during the fire, with the aim of promoting safety in tunnel operation. Inquiries concerning the publication should be addressed to the Port of New York Authority, 111 Eighth Avenue or to the National Board of Fire Underwriters, 85 John Street, New York.

Engineering Data. With the publication of Application Engineering Data on the "Parshall Flume and Weir Flow Recording Controller," the Foxboro Co., Foxboro, Mass., initiates a series of service publications for public utility men, contractors, and engineers. Copies will be sent free of charge upon application to the company. The sets are intended as practical tools for use in planning and estimating and in preparing specifications. The present set includes dimensional programs for different types of flumes and weirs, tables of flow values, and specifications for standard instruments for flow measurement or control.

Industrial Relations. Proceedings of a recent Conference on Profitable Personnel Policies, held in observance of the tenth anniversary of the Industrial Relations Section of the California Institute of Technology comprise Bulletin No. 16 of the Institute, entitled *Trends in Industrial Relations*. The booklet, priced at $1, may be obtained from the Bookstore, California Institute of Technology, Pasadena 4, Calif.

Strain Gages. A new 12-page catalogue of Baldwin SR-4 bonded resistance wire strain gages, illustrated by line drawings distinguishing 11 types of gages and listing 102 standard gages, is announced by the Testing Equipment Department of the Baldwin Locomotive Works, Philadelphia 42, Pa. These gages are classified by types of wire and cementing materials to be used.

City Planning. Highlights of the program of the Philadelphia City Planning Commission during the past year are outlined in the Commission's Annual Report for 1948. Progress made during the year in the development of a modern highway system for Philadelphia is especially emphasized. Inquiries concerning the 34-page illustrated report should be addressed to the Philadelphia City Planning Commission, Market Street National Bank Building, Philadelphia 7, Pa.

(*Continued on page 93*)

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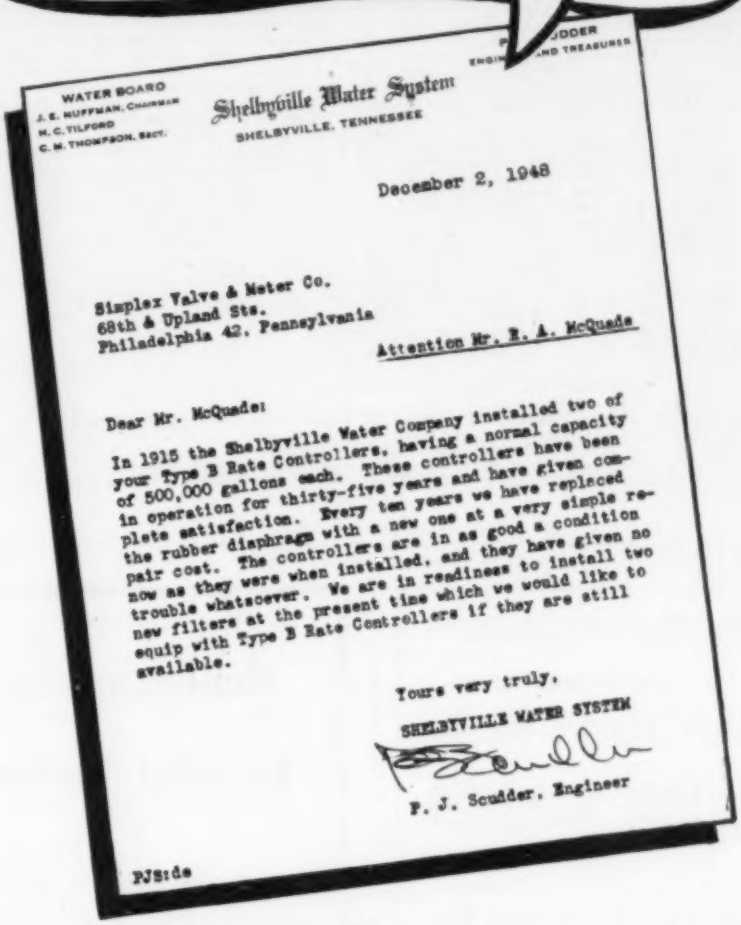
...says P. J. Scudder, Engineer, Shelbyville Water System



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December 2, 1948

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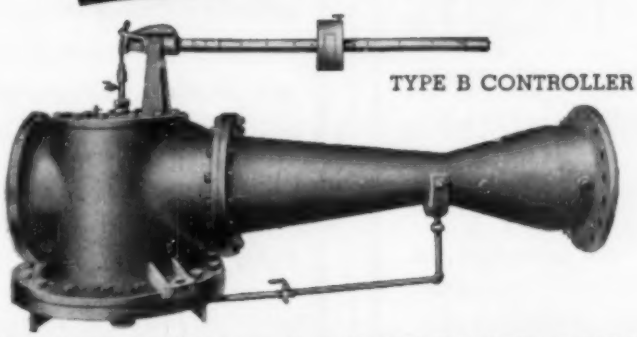

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CIVIL ENGINEER; M. ASCE; P.E. license New York State; B.S. in C.E.; 41; married; 20 years' varied experience—10 years with Corps of Engineers on construction, maintenance, procurement, and administrative work. Desires position as project manager or in management engineering field. Capable administrator with experience on large-scale projects. Prefers foreign service. C-542.

CONSTRUCTION MANAGER, ADMINISTRATIVE ASSISTANT; Assoc. M. ASCE; 43; married; graduate engineer with administrative ability and top-level experience in layout, design, estimating, and construction of commercial and industrial buildings, including machinery installations; registered professional engineer in California; available now for domestic or foreign assignment. C-543-311-C-5.

CIVIL ENGINEER; Jun. ASCE; 32; married; registered; 6 years' construction and design experience; 3 years' city engineer for municipality of 27,000 population; a year's consulting work. Available immediately. C-544-4910-A-1.

CIVIL ENGINEER; Assoc. M. ASCE; 39; married. Fifteen years' experience in heavy construction, dams, tunnels, cofferdams, and related foundations work, power plants, industrial buildings, layout and supervision of construction. Speaks Spanish. Also experience in administrative work. Available immediately. Location optional. C-545.

This placement service is available to members of the Four Founder Societies. If placed as a result of these listings, the applicant agrees to pay a fee at rates listed by the service. These rates—established to maintain an efficient nonprofit personnel service—are available upon request. The same rule for payment of fees applies to registrants who advertise in these columns. All replies should be addressed to the key numbers indicated and mailed to the New York Office. Please enclose six cents in postage to cover cost of mailing and return of application. A weekly bulletin of engineering positions open is available to members of the cooperating societies at a subscription rate of $3.50 per quarter or $12 per annum, payable in advance.

CIVIL ENGINEER; Assoc. M. ASCE; Licensed P.E. N.Y.; veteran; 24 years' experience in construction subways (8th Ave.—3 sections); R.C. highways and bridges (N.Y. State Route 17); airports (La Guardia and Pine Camp); underpinning and shoring, municipal public works and utilities. Estimating, planning construction methods and equipment. Prefers metropolitan New York. Available, January 1, 1950. C-546.

JUNIOR ENGINEER; Jun. ASCE; B.S. 1948; single; veteran; 1½ years' experience as field engineer in oil refinery layout work for all types of refinery construction; desires employment with established engineering or construction firm. Interested in becoming construction engineer; willing to learn in field or office. Prefers north or middle Atlantic location. C-547.

Positions Available

SANITARY ENGINEERS. (a) Sanitary Engineer, State Department of Health, degree in sanitary engineering, with at least 6 years' sanitary engineering experience, 2 of which were spent in responsible charge. Starting salary, $5,000 a year, retirement plan and civil service. (b) Senior Assistant Sanitary Engineer, degree in sanitary engineering, with at least 4 years' experience in sanitary engineering. Salary, to start, $4,246 a year. Location, East. Y-2282.

ENGINEERING SUPERINTENDENT with building construction experience for general contractors and builders. Salary, $7,280 a year. Location, New York, N.Y. Y-2625(a).

ENGINEERS. (a) Structural Engineer, about 40, with 10 to 15 years' design experience, familiar with waterfront work and some underground experience, to handle structures. Salary, $675–$700 a month. No income tax. Duration, 1 to 3 years. Y-2639(a).

ENGINEERS. (a) Architect, graduate, with substantial experience in layout work and architectural design of industrial buildings and capable of carrying out assignments with a minimum of supervision. (b) Structural Designer, civil graduate, with considerable experience in the design of structural steel and reinforced concrete structures, to design and lay out industrial buildings. Salaries open. Location, Massachusetts. Y-2720.

MUNICIPAL ENGINEER, preferably civil graduate, with license, and at least 5 years' actual experience in municipal public works and engineering, to act as consultant to city officials regarding engineering standards and specifications, analysis of costs and development of standards of performance, determination of equipment needs, and application of approved public works practices generally, including surveys and preparation of reports, manuals, etc., of general use and practical benefit to local municipal officials. Salary, $4,200–$5,000 a year. Location, Southern State University. Y-2757.

CIVIL ENGINEER, with at least 8 years' hydraulic experience including stream surveys, runoff, underground waters, etc., to supervise engineering survey, water-supply design and hydrological work. Salary, $7,000–$8,000 a year. Headquarters, New York, N.Y. Y-2864.

BUILDING SUPERINTENDENT, 35–40, engineering graduate, with at least 10 years' experience in supervising maintenance and operation of large buildings, to take charge of commercial buildings. Salary, $8,000–$10,000 a year. Location, East. Y-2886.

CONSTRUCTION ESTIMATOR, preferably engineering graduate, with at least 10 years' estimating experience covering home construction and general building work, to prepare cost estimates, specifications, contracts, etc., for estate development project. Salary, $5,000–$6,500 a year. Location, central New Jersey. Y-2890.

SANITARY ENGINEER, bachelor's degree in chemistry or sanitary engineering, master's degree preferred, and 2 to 3 years' experience in sanitary chemistry either in water or sewage, and a special interest in laboratory work, to perform chemical tests in the analysis of industrial waste such as biochemical oxygen demands, solids, total nitrogen, and other tests in connection with the operation of industrial waste-treatment plant. Salary, $3,300–$4,200 a year. Location, New York State. Y-2935.

SALES AND CONTRACT ENGINEER, 30–45, civil graduate. Must have had some experience on structural steel, preferably bridge work. Some

(Continued on page 92)

The City of Glendale, California

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GENERAL MANAGER

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Salary: $12,600 year

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Eastern University is seeking specialist in Photogrammetry who has had experience in surveying and practical photogrammetry, including use of stereoscopic mapping instruments and research. Background in geodesy highly desirable.

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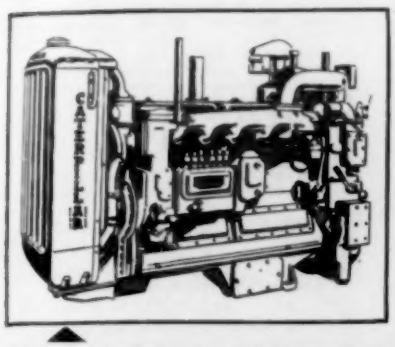
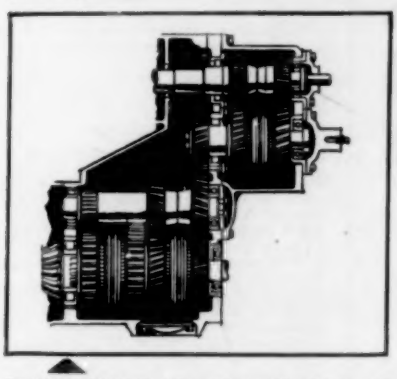


ENGINE. The heavy-duty all-"Caterpillar"-built No. 12 Motor Grader Diesel Engine is designed to function as a unit with all other parts of the machine. It has ample speed-and-power to give peak performance—plus ruggedness to meet the gruelling requirements of motor grader operation.



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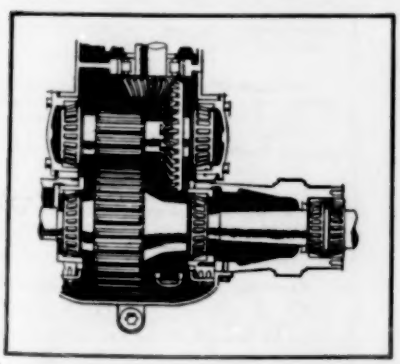

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FINAL DRIVE. Heavy-duty engine and transmission require a rugged but simple final drive system to keep the motor grader at top working efficiency. Maximum utilization of engine horsepower is realized. High-strength bevel gears and precision-machined final drive gears are assurances of long life. Tapered bearings, throughout, keep friction losses at a minimum.

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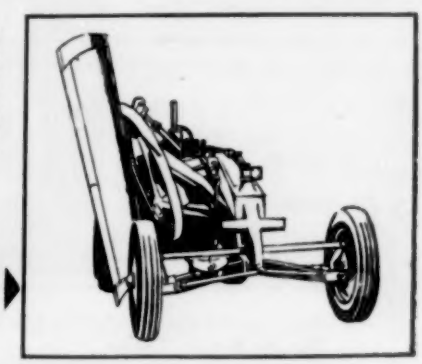

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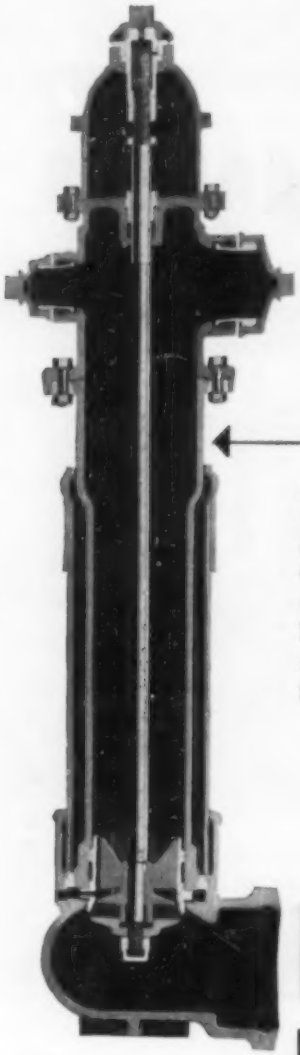

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(*Continued from page 90*)

previous sales experience desirable. Salary, $4,000–$5,000 a year. Location, eastern Pennsylvania. Y-2939.

CIVIL ENGINEER, graduate, with at least 12 years' experience, to supervise project engineers on building work, waste-disposal and structural design, for chemical company located in the East. Scheduling experience also desirable. Write stating experience, education, and salary requirements. Y-2970.

DESIGNER-DETAILER, graduate, C.E.; 8 to 15 years' experience in preparation, plans, specification, and estimates for railroad or highway construction and associated work in the office, and be willing to work on drafting board and be good at it. Must have ability to work layout problems for consulting engineer. Salary, $5,400 a year. Location, Chicago, Ill. R-5984.

ARCHITECTURAL FIELD SUPERINTENDENT. Owner's Representative, graduate architect, or civil engineer; 36–48; completely experienced outside work, structural steel, concrete and foundations for multi-story construction. Will deal with contractors, suppliers, architects, in examining, observing and inspecting work on a large project. Prefer resident of Illinois. Salary, approximately $5,500 a year. Location, Chicago, Ill. R-5987.

STRUCTURAL ENGINEER; graduate C.E.; 36–48; extensive structural experience on multi-story steel and concrete. Will represent owner to contractors, suppliers and architectural representatives, and conduct field examinations and inspections on a large project. Prefer resident of Illinois. Salary, approximately $5,500 a year. Location, Chicago, Ill. R-5988.

SALESMAN (construction material); about 30; experienced in sale of construction materials in the building business; knowledge of general building picture and acquainted with sales channels for buildings materials. Will contact contractors, architects, and dealers. Executive ability or ability to develop. Salary, $3,000–$6,000 a year. Some traveling. Location, northern Illinois. R-5989.

ESTIMATOR, recent graduate, C.E. or M.E.; 23 up. To do estimating on flooring, able to read building plans, eventually lead to sales work for manufacturer of building materials. Salary, $3,000–$3,300 a year. Location, Chicago, Ill. R-6003.

CIVIL OR MECHANICAL ENGINEER to do material-handling cataloging; 30–40; broad experience with materials handling equipment and operation of supply systems (warehousing), knowledge of materials, supplies and equipment, and spare parts. Informed on use of such materials on large construction project; will define, classify, and catalog these items. Previous experience as inspector on construction project or for manufacturer of equipment helpful. Willing to travel in or out of U.S. Ninety percent desk work for management company. Salary, $4,800 up. Headquarters, Chicago, Ill. R-6037.

PROFESSOR in sanitary engineering, with advanced degrees, to develop sanitary engineering program and to head department of civil engineering. Experience in engineering practice and in research essential. Location, East. Y-3007.

DESIGNER, STRUCTURAL; graduate or equivalent; 5 or more years' experience on industrial types of buildings of steel and concrete design and drafting. Must be able to work without much supervision. Salary, $4,800–$6,000 a year. Location, Illinois. R-6051.

ESTIMATOR; graduate or equivalent; 5 or more years' recent experience on estimating and quantity take off on commercial and industrial buildings for large construction company. Salary open. Location, Illinois. R-6054.

STRUCTURAL ENGINEER; graduate C.E. 35–40; substantial experience with concrete and steel as applied to coal preparation plants. Salary open. Location, Illinois. R-6059(b).

SANITARY ENGINEER (associate in firm); graduate C.E.; 10 to 30 years' experience with hydraulic and sanitary engineering as encountered in municipalities (water and sewage) and private industry (utilities). Wisconsin background desirable; informed about consulting engineering activity as applied to state, municipal, or public utility employment desirable. Will design, draft, contact clientele (municipal, private) for a consulting engineer established since 1939, as an associate in business. Salary open plus associates' share. Location, Wisconsin. R-6060.

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New Publications

(*Continued from page 89*)

Steel Research. Availability of several new sections in the Steel Products Manual, which is being issued in installments by the American Iron and Steel Institute, is announced by the Institute. These are Section 19 on "Railway Track Materials"; Section 20 covering "Wrought Steel Wheels; Section 22, entitled "Forged Axles and Locomotive Forgings"; and Section 26 on "Flat Rolled Electrical Steel." These may be purchased from the Institute, 350 Fifth Avenue, New York 1, N.Y., at 25 cents each. Also available from the same source is Bulletin No. 11, "Hardenability of Alloy Steels," in the Contributions to the Metallurgy of Steel series.

Air Entrainment Affects Design of Training Walls

(*Continued from page 37*)

similar to those outlined in the derivation of the hydraulic jump formula without air entrainment. In Fig. 4(*b*) is shown the hydraulic jump with air entrained in the water before the jump, where the water flowing at a velocity of V_1 and a total depth, including entrained air, of D_{1a}, jumps to a depth of D_2 with a corresponding velocity of V_2. Assuming that the entrained air is distributed uniformly throughout the depth D_{1a}, the average unit pressure is the same as for solid water and equals $^1/_2\ wD_1$. Hence the hydrostatic pressure, P_{1a}, before the jump is equal to

$$\frac{1}{2}\,wD_1D_{1a} = \frac{1}{2}\,wD_1^2\left(1 + \frac{m}{100}\right)$$

in which P_{1a} = upstream hydrostatic pressure with entrained air, D_1 = depth with no air, D_{1a} = total depth including entrained air, and m = ratio of entrained air to water by volume.

Equating the two expressions for the unbalanced static force causing change in momentum, substituting and reducing, as in the construction of Eq. 4, the jump equation with entrained air becomes

$$D_2^2 = 0.06234\,QV_1 + D_1^2 - 0.06219\,\frac{Q^2}{D_2} \quad . . (5)$$

From Eqs. 4 and 5 it is noted that the only difference between the two hydraulic jump formulas, with and without air entrainment, lies in the different values of the coefficient of the common term QV_1. This difference is obviously very small; hence for purposes of practical design it is permissible to use the actual velocity and the net depth of water without air entrainment in hydraulic jump computations.

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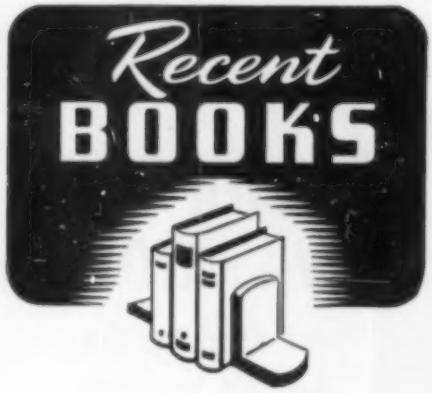

ADVANCES IN APPLIED MECHANICS, VOLUME I. Edited by R. von Mises and T. von Kármán. Academic Press, New York, 1948. 293 pp., diagrs., charts, tables, 9¼ × 6 in., cloth, $6.80. Intended for students and engineers who are unable to follow up all the research papers currently published, this first volume of a series presents six papers on recent developments in the field dealing with the following topics: the mechanics of boundary layer flow; nonlinear mechanics; elasticity; a mathematical model illustrating the theory of turbulence; numerical methods in wave interaction problems; and Bergman's integration method in two-dimensional compressible fluid flow.

APPLIED MECHANICS. 2 ed. By H. F. Girvin. International Textbook Co., Scranton, Pa., 1949. 417 pp., diagrs., charts, tables, 9¼ × 6 in., cloth, $5.25. Intended as a text for sophomore students, this book covers the material generally included in a course in applied mechanics. This second edition provides extended discussion of many topics and additional illustrative examples. In the sections dealing with kinematics, the notation is brought into line with current practice. About 300 new problems are added, bringing the total to over 1,000 examples and problems.

A.S.T.M. SPECIFICATIONS FOR ROLLED STRUCTURAL STEEL. American Society for Testing Materials, 1916 Race St., Philadelphia 3, Pa., May 1949. 34 pp., diagrs., tables, 9 × 6 in., paper, $1. This pamphlet contains new and revised structural steel specifications together with the general requirements for delivery of rolled steel plates, shapes and bars for structural use.

CHEMIE FÜR BAUINGENIEURE UND ARCHITEKTEN. 4th rev. ed. By R. Grün. Springer-Verlag, Berlin, Göttingen, Heidelberg, 1949. 212 pp., illus., diagrs., charts, tables, 9½ × 6½ in., paper, 16.50 DM. Written for construction engineers and architects, this book considers the chemistry of inorganic and organic construction materials. Stone, cement, sandstone, brick, iron and steel, and light metals are discussed, as well as wood, asphalt, artificial resins, roofing boards, adhesives, putty, and paints. A list of related magazines is included.

ENGINEERING MATERIALS AND PROCESSES—METALS AND PLASTICS. 2 ed. By W. H. Clapp and D. S. Clark. International Textbook Co., Scranton, Pa., 1949. 526 pp., illus., diagrs., charts, tables, 9¼ × 6 in., linen, $6.50. The physical properties and uses of the principal metals and plastics are discussed, including a description of the methods by which these materials are processed. In this second edition the greatest changes are in the chapters on cooling curves and equilibrium diagrams, plastics, castings, and joining of metals. New basic processes are included in most of the chapters.

ÉTANCHÉITÉ DES TOITURES-TERRASSES—PROCÉDÉS MULTICOUCHES. L'Institut Technique du Bâtiment et des Travaux Publics, 28 Boulevard Raspail, Paris VII^{e}, 1949. 35 pp., diagrs., tables, 10½ × 8¼ in., 250 frs. This officially authorized publication presents recommended methods for the construction of flat roofs by multiple-layer methods, with particular attention to watertightness. Structural and covering materials, joints, drainage equipment, and supporting structures are described and illustrated.

GEOLOGY FOR ENGINEERS. By J. M. Trefethen. D. Van Nostrand Co., Toronto, New York, London, 1949. 620 pp., illus., diagrs., charts, tables, maps, 9¼ × 6 in., cloth, $5.75. This book presents certain fundamentals of geology which will provide engineers with the basic knowledge they need for their work and to enable them to use the geological investigations of others. Courses in physics, mechanics, and surveying are required prerequisites. Geological structures, subsurface water, earth movements, and shorelines are among the important topics considered. An extensive mineral-identification table appears in the appendix.

NATIONAL RESEARCH COUNCIL, HIGHWAY RESEARCH BOARD. Proceedings, 28th Annual Meeting. Edited by R. W. Crum, F. Burggraf and W. N. Carey, Jr. National Research Council, Washington, D.C., 1949. 538 pp., illus., diagrs., charts, tables, 9¾ × 6½ in., cloth, $7.50. This volume contains the papers and reports presented at the 1948 annual meeting of the Board which were not published elsewhere. The papers are grouped under 6 broad classifications as follows: economics, finance, and administration; design; materials and construction; maintenance; traffic and operations; and soils. Committee reports on a variety of subjects are published including the report of the new Committee on Night Visibility.

PRESTRESSED CONCRETE, Proceedings of the Conference held at the Institution, February 1949; published by the Institution of Civil Engineers, Great George St., Westminster, London, S.W.1, England, 1949. 132 pp., illus., diagrs., charts, tables, 8½ × 5½ in., paper, 7s.6d. This long paper reviews the present position of prestressed concrete construction, sets out in general terms the methods of design and construction used, and gives examples of actual structures built in Great Britain and elsewhere. A brief history of the early development of prestressed concrete is included.

ROUTE SURVEYS. By R. R. Skelton, Assoc. M. ASCE. McGraw-Hill Book Co., New York, Toronto, London, 1949. 531 pp., illus., diagrs., charts, tables, 7¼ × 4¼ in., cloth, $4.50. This book incorporates in one volume fundamental and practical considerations required by the engineer concerned with various types of route location. Emphasis is placed upon the importance of the engineering approach to the problems involved and the economic factors which influence route selection and location.

REPORT UPON THE RECLAMATION OF WATER FROM SEWAGE AND INDUSTRIAL WASTES IN LOS ANGELES COUNTY, CALIFORNIA. Board of Engineers, C. E. Arnold, H. E. Hedger and A. M. Rawn, April 1949. County Sanitation Districts of Los Angeles County, 1206 Maple Ave., Room 330, Los Angeles 15, Calif. 159 pp., illus., diagrs., charts, maps, tables, 11 × 8½ in., cardboard, gratis, as long as the supply lasts. Characteristics of sewage and industrial wastes and the quality of reclaimed water are discussed in this report. It reviews the laws and regulations pertinent to the use of reclaimed water, and discusses specific uses for agriculture, in-

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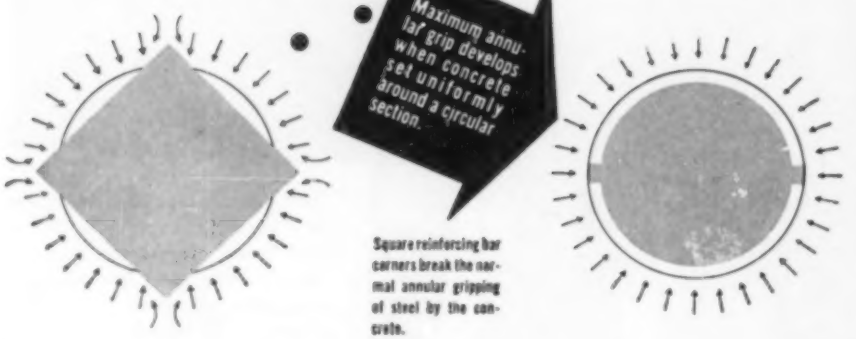
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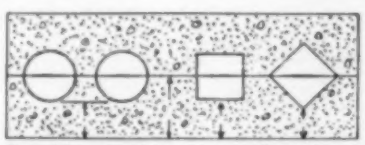

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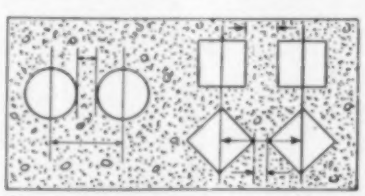

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dustry, groundwater recharge, etc. The problem as applicable to Los Angeles County is considered in some detail with maps and cost analyses. The final report of a sewage reclamation test project is included.

SEISMICITY OF THE EARTH AND ASSOCIATED PHENOMENA. By B. Gutenberg and C. F. Richter. Princeton University Press, Princeton, N.J., 1949. 273 pp., charts, maps, tables, 11 × 8 in., cloth, $10. This is an account of the relative seismicity of various parts of the earth during the limited period since about 1904, for which sufficiently accurate data are available. Geographical and geological relations of the principal earthquake zones and areas are discussed, including correlation with mountain structures, oceanic deeps, gravity anomalies, and active volcanoes. There are lists of active volcanoes, lists and tables of earthquakes and earthquake activity, and a bibliography.

STATICALLY INDETERMINATE FRAMEWORKS. 3 ed. By T. F. Hickerson. University of North Carolina Press, Chapel Hill, N. C., 1949. 202 pp., diagrs., tables, 11 × 8½ in., cloth, $5. A textbook dealing primarily with the analysis of the bending stresses in bridge and building frames, in which the procedure of applying the actual degree-of-fixation at the ends of the loaded members of the structure is utilized. The chapter on arches has been omitted, but new material has been added covering special analytical methods and simplifications of certain cases such as the determination of wind moments. Tables of continuous-frame properties are included for use in applying the methods discussed.

STAINLESS STEELS. By C. A. Zapffe. American Society for Metals, 7301 Euclid Ave., Cleveland, Ohio, 1949. 368 pp., illus., diagrs., charts, tables, 9¼ × 6 in., fabrikoid, $5. Intended as an elementary text for consumers, this book describes the fundamentals of stainless steel. Only a smattering of metallurgy and a real interest in the subject are required. Wrought alloys and corrosion resistance are the principal subjects covered. A glossary and a selected bibliography are included.

STEAM POWER PLANTS. By P. J. Potter. Ronald Press Co., New York, 1949. 503 pp., illus., diagrs., charts, tables, 9½ × 6¼ in., cloth, $6.50. Intended for use by both engineering students and engineers in industry, this book presents the fundamental principles of design of steam power-plants. Flow of fluids, pumps, heat transfer, fuels and combustion, steam generators, engines and turbines are all treated in detail. There is no discussion of the various kinds of equipment that are available nor of empirically designed apparatus. Included are many problems and examples taken from practical situations.

TECHNICAL ASSISTANCE FOR ECONOMIC DEVELOPMENT. United Nations, Lake Success, New York, May 1949. 328 pp., tables, 9 × 6 in., paper, $2.50. This report considers a comprehensive plan for an expanded cooperative program of technical assistance for economic development through the United Nations. Part I sets out the objectives and nature of the program, the field of work covered, and the proposed organizational and financial arrangements. Part II contains the proposals and statements of the various organizations involved.

TECHNICAL SKETCHING AND VISUALIZATION FOR ENGINEERS. By H. H. Katz. Macmillan Co., New York, 1949. 163 pp., illus., diagrs., charts, 10¼ × 7½ in., cloth, $5. This book is a text and reference on the applications and technique of technical sketching. Initial chapters describe the various types of sketches, and following chapters give thorough, step-by-step instruction in drawing. A final chapter describes various nongraphical means of visualization used in engineering, such as cutouts, overlays, clay models, etc.

TOOL ENGINEERS HANDBOOK. Edited by F. W. Wilson. McGraw-Hill Book Co., New York, Toronto, London, 1949. 2,070 pp., diagrs., charts, tables, 9¼ × 6 in., cloth, $15. Of interest to all associated with the mechanical manufacturing industries, this reference book covers all phases of planning, control, design, tooling, and other operations involved in the processing of finished products. It is based, wherever possible, on published governmental, associational, and industrial company standards, and contains many definitions, symbols, equations, tables and charts, in addition to methods, practices and procedures. The more than 2,000 pages of basic factual data are divided into separate chapters for the major types of tools and processes.

Los Angeles Builds Three Hydro Plants in Owens River Gorge

(*Continued from page 27*)

tions reach 6,700 ft. From the Aluminum Co. of America, 4,326,000 ft of conductor, weighing approximately 5,308,000 lb, has been purchased on contract.

Tower design allows a maximum loading of ½ in. of ice and a coincident transverse wind of 8 lb per sq ft of projected conductor area. Suspension towers will be capable of withstanding one broken conductor or one broken static wire under this condition of loading. Maximum tension on the conductors will be approximately 10,000 lb under heavy loading conditions. Tower sites have been staked, and force-account construction of tower footings has started in the Mojave section.

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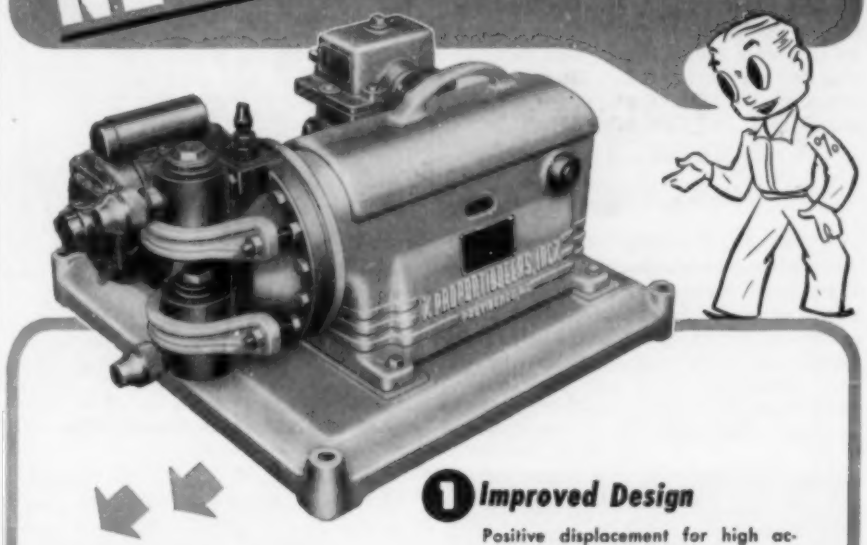

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A VERSATILE POWER DIGGER, tractor powered and hydraulically operated, that is designed especially to fill the gap between expensive hand labor and existing costly excavating equipment, found ready acceptance in virtually all fields when it was introduced. The unit is a heavy-duty digger that is light-weight and easy to move. It is easily used to dig ditches,

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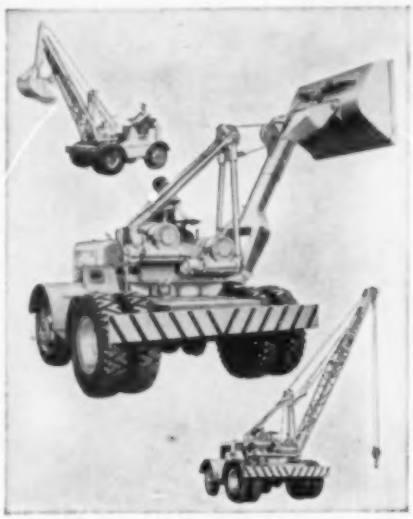
septic tank holes, footings, culverts, drains and graves, and is ideal for underground utility repair work and for working in tight places. All digger motions are hydraulic. There are no rack gears, cables, reels, clutches or chains to give trouble. The shovel has a below ground surface reach of 6 ft and an 11-ft digging reach behind the tractor. The digger has a 93° swinging arc and can be operated at a rate of 50 lineal ft at 6-ft depth in an hr. The standard shovel cuts an 18 in. wide trench and has a capacity of 3.5 cu ft. The entire unit can be installed on or removed from a tractor in 30 to 45 min. **Sherman Products, Inc., Royal Oak, Mich.**

Swing Loader

THE SWING LOADER, featuring full hydraulic operation, 180° swing and quick change convertibility to mobile crane or backhoe, is now available. As a loader, the unit is designed for standard ¾ yd material bucket and up to 2 yd snow handling bucket. It is capable of loading from any point in a 10 ft wide swath and also above grade and can swing 90° to either side to dump, permitting work within 2 ft of trucks. Utility of the machine is increased by its quick convertibility to an



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excavator and trencher by installation of ⅛ yd backhoe attachment in place of loader, or to a mobile 3-ton crane operating boom of 10 to 23 ft length which can be swung 180° without outriggers to pick up or place loads. Traction speeds range from low-low gear to 15 mph for yard crane work and self-transportation over roads and city streets. **The Mandt Mfg. Co., 490 W. Goodale St., Columbus 8, Ohio.**

Pur-O-Cel Filter System

WHEN DROUGHT CONDITIONS recently caused a critical water shortage at Gasport, N.Y., Proportioneers pur-o-cel filtration equipment was flown from the factory to the parched area. This diatomaceous earth pressure filter processed up to 90,000 gal of water per day from an impounded creek, and a chem-o-feeder treated the supply with hypochlorite. The compact size, only about 3 by 6 ft, and the high quality of the finished water were reasons for the selection of pur-o-cel, which is also widely used to provide crystal clear water for swim pools, bottling plants, and other installations. **Proportioneers, Inc., 9 Codding St., Providence, R.I.**

Fireproofing Cement

BEAMS AND OTHER INDUSTRIAL equipment made of steel can now be given a light-weight protective coating to keep them from collapsing in the event of fire. When applied in a layer only 1¾ in. thick, the cement will retard the effect of great heat for 3 hr. The protective cement has only a fraction of the weight of most other materials used in the past for this type of fireproofing, the company asserts, and can be easily troweled on without the use of forms. A further advantage claimed for the material is the ability to resist spalling or crumbling. One of the main fields of usefulness for the fireproofing procedure is expected to be in chemical plants, oil refineries, and other types of industrial installations where exposed steelwork is part of the structure. It is sold as a gray, powdered material which is mixed with water to form a stiff paste and then troweled onto ribbed metal lath wrapped around the steelwork to be protected. **Eagle-Picher Co., Cincinnati 1, Ohio.**

Hydro-Trencher

THE OLIVER INDUSTRIAL TRACTOR with a Ware hydro-trencher attachment has been introduced at several expositions and found to be the center of attraction. The hydro-trencher can be easily installed on either a Model 77 or Model 88 Oliver wheel tractor. This inexpensive unit has two hydraulic outriggers that provide a

Easily Installed On Model 77 Or 88 Wheel Tractor

sturdy base for the entire combination and remove strains from the tractor while digging. The front of the tractor is held in place by counterbalancing weights. The boom is hydraulically operated and swings to either side allowing placement of earth in any desired location. The backhoe can be changed to a conventional shovel bucket for loading operations, or the entire trencher unit can be quickly removed and the tractor used for other duties. This novel Oliver-Ware combination has shown a remarkable ability to compete favorably with many special ditch-digging units and backhoes. **The Oliver Corp., Cleveland 17, Ohio.**

Equipment Materials & Methods (Continued)

Cranes

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25-Ton Mobile Crane

of the cranes are powered by a heavy-duty 517 cu. in. displacement industrial type gasoline engine. Engine, machinery and A-frame supports are mounted on a full-length one-piece unit-cast alloy-steel rotating base or bed plate to maintain rigid alignment. Hoist and auxiliary hoist drums are ball-bearing mounted on separate shafts. Power is transmitted through quiet, smooth running helical gears and wide external-contracting band-type clutches. Telescopic boom backstops provide additional safety when boom reaches maximum operating angle. A special load-lowering mechanism is furnished for accurate control in the handling of heavy loads instead of relying on foot brake alone. Safety guards installed over clutches and main gears are covered with protecting guards. Catalogs including detailed specifications and lifting capacities are available upon request. **Bay City Shovels, Inc., Bay City, Mich.**

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(*Continued on page 98*)

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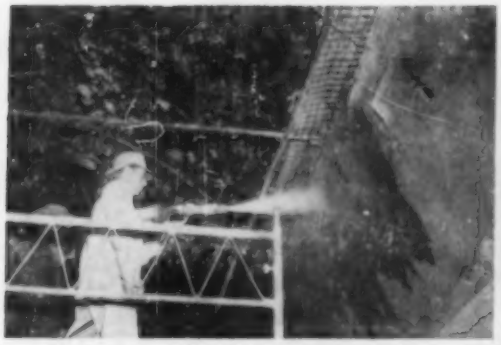

HOLLAND TUNNEL REPAIRED QUICKLY WITH "GUNITE" AFTER SPECTACULAR FIRE

Even before the recent Holland Tunnel fire had been completely extinguished, the Port of New York Authority was at work on the problem of restoring the tube to full usage. Work had to be done as quickly as possible in a manner which would meet the Port Authority's extremely high standards for construction.

The Cement Gun Company was selected to do portions of the job with "GUNITE" because of our ability to meet both requirements best. Side walls and ceiling concrete were chipped back to sound material and built out to original lines with "GUNITE." The new metal ceiling was covered on the underside with 1¼" reinforced "GUNITE." Our trained crews outfitted with mobile equipment were on the spot quickly and we completed the job in an amazingly short time, despite the fact that traffic moved through the tunnel during the day and that we would work only at night.

Many instances of repair, remodeling and new construction with "GUNITE" are described and pictured in Bulletin B2400. A request on your letterhead will bring your free copy by return mail.

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Equipment, Materials & Methods (Continued)

new film easily retains the minute detail and fine lines often found in map-making. Extensive trade tests have shown it to be excellent for geophysical, geological, and land survey maps. The high translucency of the film base also permits maximum print-back speeds in making blueprint or whiteprint copies from film intermediates. The film has a matte surface on both sides, permitting additions or corrections in either ink or pencil. Erasures may be made by using a standard two-solution eradicator. The film is available in both 30 and 100 ft rolls in the standard widths of 24, 30, 36, 42, and 44 in. **Eastman Kodak Co., Rochester 4, N.Y.**

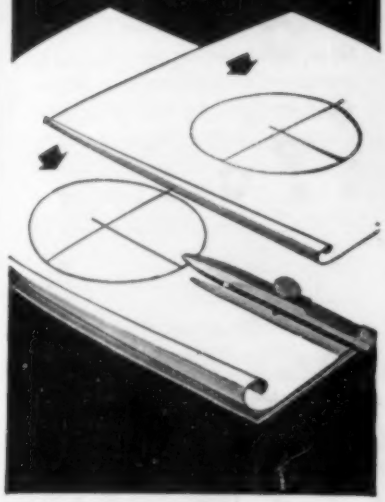
Trucks

A COMPLETELY RE-DESIGNED and re-engineered line of International trucks has been announced. The new L-line, a complete line of heavy-duty-engineered trucks consisting of 87 separate truck chassis models designed to handle every conceivable type of hauling job features complete restyling, a "Comfo-Vision" cab and new chassis dimension engineering.

Features "Comfo-Vision" Cab

The modern appearance achieved is the result of combining beauty of line with a utility that permits more roominess, added driver comfort and convenience, increased safety and new all-around visibility—factors which result in greater operator efficiency and thus spell more profitable truck operation. The curved contour instrument panel offers the utility and appearance features of the more smartly designed passenger car panels. Instruments are arranged in two easily reached clusters. The push-button, magnetic-switch-type starter is at the driver's fingertips on the panel. The dimensions of the chassis provide better load distribution, greater maneuverability, shorter over-all lengths and improved engine accessibility. Biggest change in chassis dimensions is in the wheelbases, which have been shortened as much as 7 in. in some models, so that there is a balance between front and rear axles. The new Silver Diamond engine is a valve-in-head, six-cylinder power plant and is built in two sizes. **Motor Truck Div., International Harvester Co., 180 N. Michigan Ave., Chicago 1, Ill.**

Tracing cloth that defies time



● The renown of Imperial as the finest in Tracing Cloth goes back well over half a century. Draftsmen all over the world prefer it for the uniformity of its high transparency and ink-taking surface and the superb quality of its cloth foundation.

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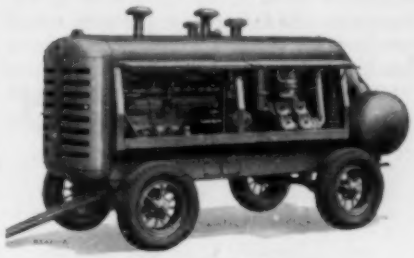
Equipment, Materials & Methods (Continued)

Mobil-Air Compressor

FOR USERS WHO PREFER full diesel-engine drive for their portable compressors, a 500 cfm mobil-air compressor has been announced. The engine is the well-known International Harvester heavy-duty UD-24 which starts easily as a low-compression gasoline-engine and after a short warmup period is shifted to full diesel operation by means of a single lever. This

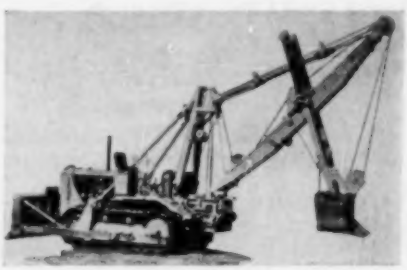


Model IKA-500

portable, known as the IKA-500, features a floating-speed regulator, two-stage air-cooled compressor, hydro-shift flex-disk clutch, channel valves, and sturdy running gear and mountings. In addition, the compressor is said to have a more efficient air cleaner which is easier to service. For additional information write **Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.**

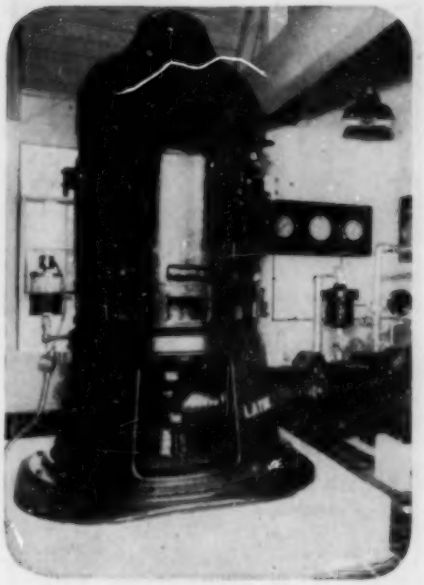
Shovel Front

A $^1/_2$ CU YD CAPACITY shovel front will be available for the tractor-mounted Hystaway. The addition of this attachment brings the number of interchangeable Hystaway variations to seven, other options being a crane, dragline, clamshell, hoe front, bulldozer and pile driver. Designed only for the "Caterpillar" D7 and D8 track-type tractors, the shovel front may be mounted on either new or used machines without major alterations.



Easily Manuevered

Features of the unit include ample power, fast swing, long reach, and absence of tail swing. Because of the maneuverability of its tractor base, the excavator can get into and work jobs difficult for the average shovel to handle. It is well adapted for such jobs as road grading, gravel pit excavation, loading in stone quarries, excavating basements and foundations, excavating in borrow pits, railroad grading and airport grading. Specifications for the new attachment are available on form number 1130. **Hyster Co., Portland 8, Ore.**



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It is good business to make high efficiency a yardstick in buying a well water system. It is good to know that from Layne you automatically obtain the high efficiency that continually keeps your water production and upkeep at rock bottom cost. For further information, catalogs, etc., address LAYNE & BOWLER, INC., General Offices, Memphis 8, Tenn.

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Equipment, Materials & Methods (Continued)

Diesel Locomotive Crane

A NEW 10-TON DIESEL locomotive crane, Model 410, offers minimum weight, moderate first cost, and efficient, economical operation. A small crane with big crane features, the 410 is a trim and compact job, engineered especially for high speed work and for use on lighter jobs where the use of a larger crane would be less economical. Powered by an electric-starting diesel engine developing 72 hp at 1,600 rpm, it has a rated capacity of 20,000 lb with a 40-ft boom at 12-ft radius. It has a full

Model 410

vision cab, tandem band air-controlled clutches, and will perform all operations simultaneously. The three speed selective transmission allows shifting from one speed to another, while the crane is in motion. A 4-page catalog covering the Model 410 can be obtained by writing to the **Advertising Dept., American Hoist & Derrick Co., St. Paul 1, Minn.**

Hydraulic Pump

A CONVERSION KIT FOR adapting snow plows and mowers to a power hydraulic lifting system is now offered to highway maintenance engineers. The unit is easily installed and can replace either hand or other mechanical lifts. It requires no changes in rams or lifting arms. The equipment, called Hydro-Pac, is driven by an electric starter motor which takes its power from the battery on the truck or tractor. No belt or power take-offs are required. The lift is controlled by pressing a button on the dash board which raises or lowers the lifts. Control is instantaneous so that blades and cutter bars can be floated over obstructions. The unit will raise most snow plow blades in 8 sec. For complete information, write the **Donnell Hydraulic Co., Garden Prairie, Ill.**

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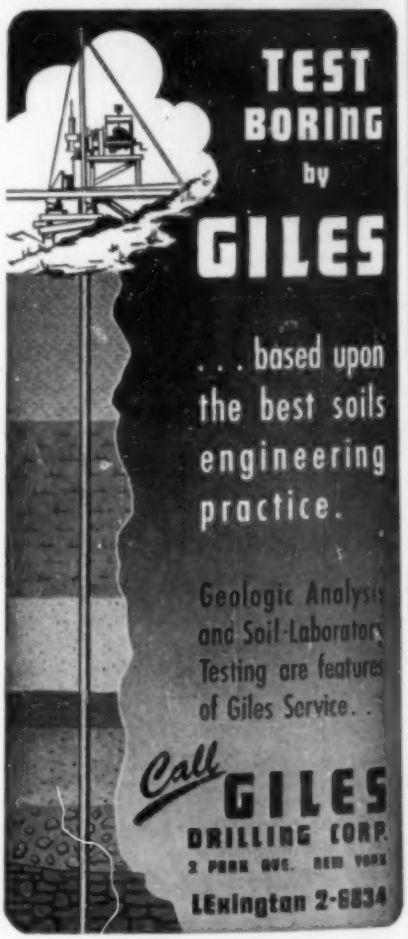

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Equipment, Materials & Methods (Continued)

Crane Excavator

A 1/2-YD CRAWLER-MOUNTED excavator, known as the Model 66, has been announced. The weight of 30,398 lb as a trench hoe seems to indicate exceptionally sturdy construction for a 1/2-yd machine. It is easily convertible to shovel, dragline, clamshell and a magnet or 7.5-ton utility crane. It is powered through direct drive propeller shaft assembly from the new "direct power flow" transmission. This transmission is remotely located from the power unit and is connected by a right angle drive and universal drive shaft. This design favors

Model 66

easier and less costly maintenance and replacement, and practically eliminates noise and backlash common to chain and gear drives. The upper works of the Model 66 is enclosed in a weatherproof, inside bolted cab of a design which permits inside access to all deck machinery. The new excavator has an all-welded chassis and travels, lifts, booms and swings simultaneously or independently. The swing speed is 6.2 rpm. **Wayne Crane Div., American Steel Dredge Co., Inc., Fort Wayne 1, Ind.**

Heavy-Duty Motor Grader

THE HUBER GRADER is the result of many months of careful engineering study, planning and exhaustive tests in the field.

Powered by 130 hp Diesel Engine

Weight of the grader is 24,500 lb without scarifier. Blade pressure without scarifier is 12,440 lb. Over-all length of the machine is 25 ft 9 1/2 in., width is 7 ft 10 in and height with cab 10 ft 4 in. Outstand-

(*Continued on page 102*)

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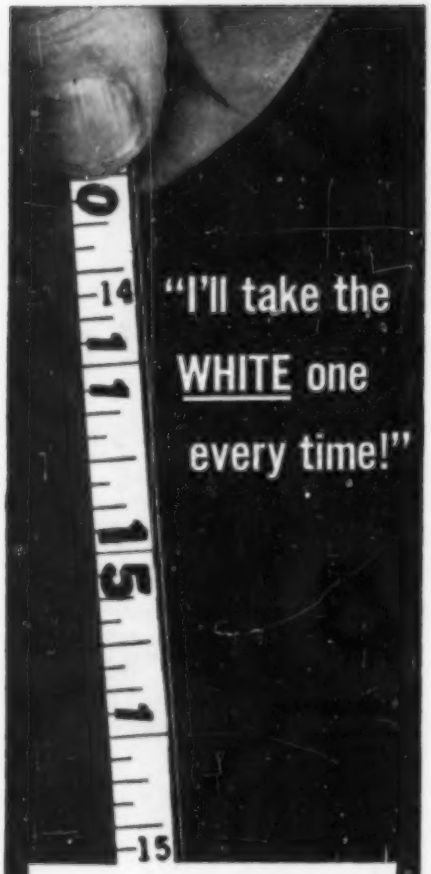

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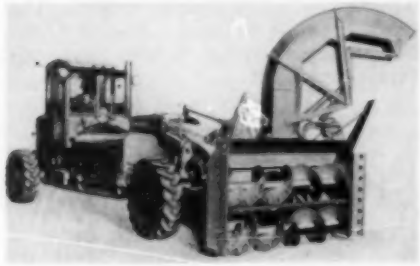
Equipment, Materials & Methods (Continued)

ing features of the grader include hydro-mechanical controls; 27½ in. front axle clearance; 87 in. shoulder reach; mechanical steering; Hercules 130 hp full diesel engine; 4-wheel hydraulic brakes and easy accessibility to all operating parts for maintenance and service purposes. Another feature of the grader is the manner in which the wheels remain perpendicular to the ground even when running over sizeable obstacles. The grader can roll over obstacles up to 14 in. high or into a ditch 14 in. deep without changing the leaning angle. This eliminates side-slipping, and the machine doesn't roll on the side of the tire. This feature enables the operator at all times to maintain the grader in the most desirable working position. The closed cab, offered as optional equipment, provides fine visibility, comfort and plenty of headroom. **Huber Mfg. Co., Marion, Ohio.**

Snow Master

AN EXCLUSIVE CONTRACT with Sicard, Inc., builders of the well-known Sicard snow master rotary plow, establishes Austin-Western as the sole distributor of the machine, when used as a grader attachment. Completely controllable casting is achieved in the Sicard snow master through its patented revolving telescopic chute. Snow can be cast in a full 220° arc for any distance from 3 ft to more than 150 ft. Trucks can be loaded from either side of the machine, or from the front at no sacrifice of operating efficiency.



Grader with Snow-Caster attached

Blower housing and wrist action chute combined, enable the operator to cast to the exact spot desired, missing driveways, intersections, power wires, or any other obstructions. Rotary snow plows can be backed by the power and control of four wheel drive and steer. Four wheel drive furnishes traction for every pound of weight while four wheel steer adds the maneuverability so necessary when rounding sharp corners, or working on narrow streets or in crowded quarters of any kind. Austin-Western power graders, with their exclusive features of all-wheel drive and all-wheel steer, precision side shift, and controlled traction, can be converted in a few hours from their normal grading operations to use with the Sicard Snow Master. **Austin-Western Co., Aurora, Ill.**

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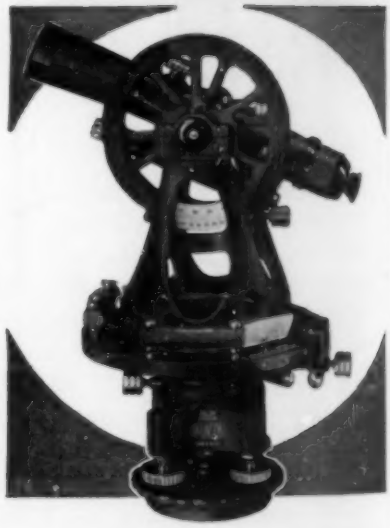

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Literature Available

AGGREGATE SPREADER—Bulletin S.P.S. 9 describes the new Jaeger self-propelled aggregate spreader. This bulletin points out all the features designed in the spreader and a page is dedicated to specifications. Illustrations are also included. **Jaeger Machine Co., Columbus 16, Ohio.**

WELDED FIELD JOINTS—A 4-page folder, designated as Form 559, offers concise data on how arc-welded field joints reduced the cost of a steel water main in Minneapolis. Illustrations and diagrams are enclosed in this worth-while offer. **R. W. Saunders, Bethlehem Steel Co., Bethlehem, Pa.**

POWER-WHEEL BUCKETS—Giving an ideal combination of speed, capacity, strength, low upkeep, rope economy, and compact dimensions is the Haiss power-wheel bucket for rehandling. Many pictures, charts, and diagrams make up this 8-page, 2-color booklet. **George Haiss Mfg. Co., Inc., Div. of Pettibone Mulliken Corp., 141st St. on Park Ave., New York 51, N.Y.**

WIRE ROPES—Stainless steel and Monel metal wire ropes are becoming more popular where corrosion affects uncoated carbon steel and galvanized ropes. One hundred and thirty-three different sizes and types are catalogued in folder No. 49-30. Typical uses for each rope are listed and the various types available are described and illustrated. **R. G. Diehl, Macwhyte Co., Kenosha, Wis.**

TREAD-SURE—is a plastic brush-coating that produces an antiskid surface on wood, concrete or steel deck flooring. A 4-page folder describes in detail the directions and specifications of this, as well as many other flooring products. Tread-sure is used on floors, stairs, and ramps for non-slip, non skid safety footing. **A. C. Horn Co., Inc., 10th St. & 44th Ave., Long Island City 1, N.Y.**

SOIL TESTING EQUIPMENT—Specification sheets describe complete line of soil-testing equipment including unconfined compression devices, McRae motorized soil lathe, tri-axial shear apparatus, sample ejector, consolidation specimen trimmer, power hack saws, etc. Descriptions of operation, construction, and advantages are provided for each device. **Soil Testing Services, Inc., 525 N. Noble St., Chicago 22, Ill.**

JALLOY—Publication of a 36-page brochure "For Longer Wear, Less Repair" is Jalloy. Jalloy is a new special alloy steel which is capable of being heat-treated to excellent physical properties. It is being used in the mining, quarrying, and earth-moving industries with outstanding success where abrasion and impact resistance are major factors in the service life of steel.

JUNIOR BEAMS—A new booklet describing junior beams, titled "Skyscraper Construction for Every Building," is announced. The 24-page booklet gives complete technical data on installation, is attractively presented and amply illustrated with photographs of junior beam floor joist and roof purlin installations in progress. **Jones & Laughlin Steel Corp., Pittsburgh 30, Pa.**

One of the World's Largest Grain Elevators is founded on Koppers PRESSURE-CREOSOTED PILES

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For *your* protection, Koppers now burns its brand into every one of its pressure-creosoted piles; this brand is your assurance of quality. The Koppers Brand is placed 10 feet from the butt of each pile. You and your inspector can tell at a glance exactly what you are getting in preservative and retention.

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KOPPERS COMPANY, INC., Pittsburgh 19, Pa.

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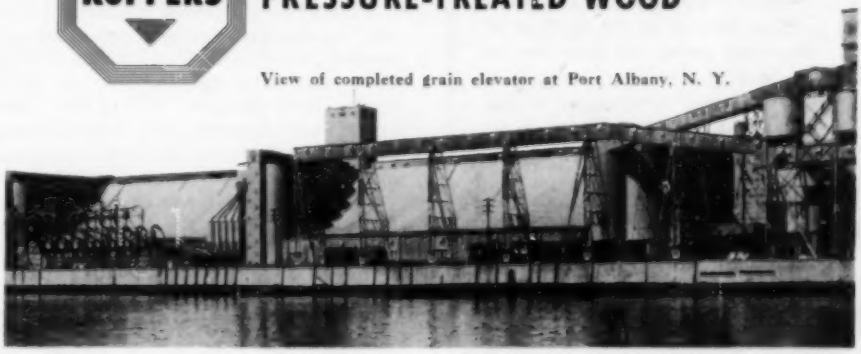
View of completed grain elevator at Port Albany, N. Y.



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Films Available

MOTOR GRADERS—Production and distribution of "Better Blading," a 20 min full-color movie treating exclusively the manufacture of and the work capabilities of the "Caterpillar" Diesel No. 12, No. 112 and No. 212 motor graders, has been announced. Photographed by Caterpillar camera crews employing photography techniques new to industrial film production, the film portrays the design and engineering features which the manufacturer has built into its three sizes of motor graders to accomplish desired performance for users. **Caterpillar Tractor Co., Peoria, Ill.**

TRANSIT PIPE—A new sound motion picture entitled "Underground Arteries—The Story of Transite Pipe," has just been completed. It is in full color and the showing time is 32 min. The picture begins with a series of scenes showing the importance of pure, fresh water in the daily life of a typical community. Next, attention is directed to the supply and distribution lines. While discussing these "underground arteries" the narrator introduces transite pipe. Then, various steps in the manufacture of this asbestos-cement pipe are shown followed by scenes illustrating installation features of the product. Arrangements for showings of this picture can be made by writing to **Johns-Manville, 22 E. 40th St., New York 16, N.Y.**

EXCAVATOR & CRANE MACHINE—Completion of a 16 mm sound and full color motion picture featuring the Traveler, 1/2 and 5/8 cu yd rubber-tired excavator and crane, is announced. "There's a Difference" is appropriately titled as it consists of 20 min of action-packed scenes showing the differences which are built into the machine, as well as various job applications for which the Traveler is well known and well equipped—and including scenes which elaborate on other outstanding features of the highly mobile Traveler. "Shots" of actual job applications using shovel, crane, backhoe, dragline and clamshell attachments complete the story of the machines mobility and versatility. **Sales Division, The Byers Machine Co., Ravenna, Ohio.**

CEMENT—Few people realize the massive equipment, intricate processes and careful attention to detail which go into the making of portland cement—the basic ingredient of concrete. To explain clearly and interestingly the what, how and why of the world's most versatile structural material, the Portland Cement Association, 33 W. Grand Avenue, Chicago 10, Ill., has just released a new film entitled "The Drama of Portland Cement." Please address requests for bookings to Portland's film distribution agency, **Modern Talking Picture Service, Inc., 142 E. Ontario St., Chicago 11, Ill.**

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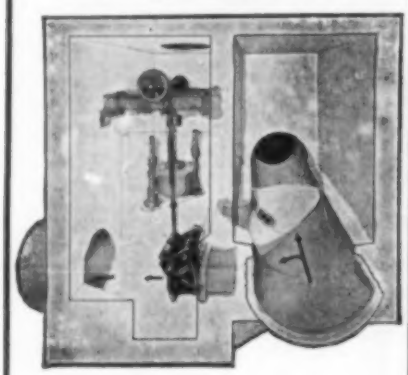
Fig. B-19
Automatic Sewage Regulators control sewage flows either by partially or completely cutting off such flows to suit head or tail water conditions or by "governing" to discharge a predetermined quantity regardless of head or tail water conditions.
Descriptive Bulletins and Engineering Data Available Upon Request.
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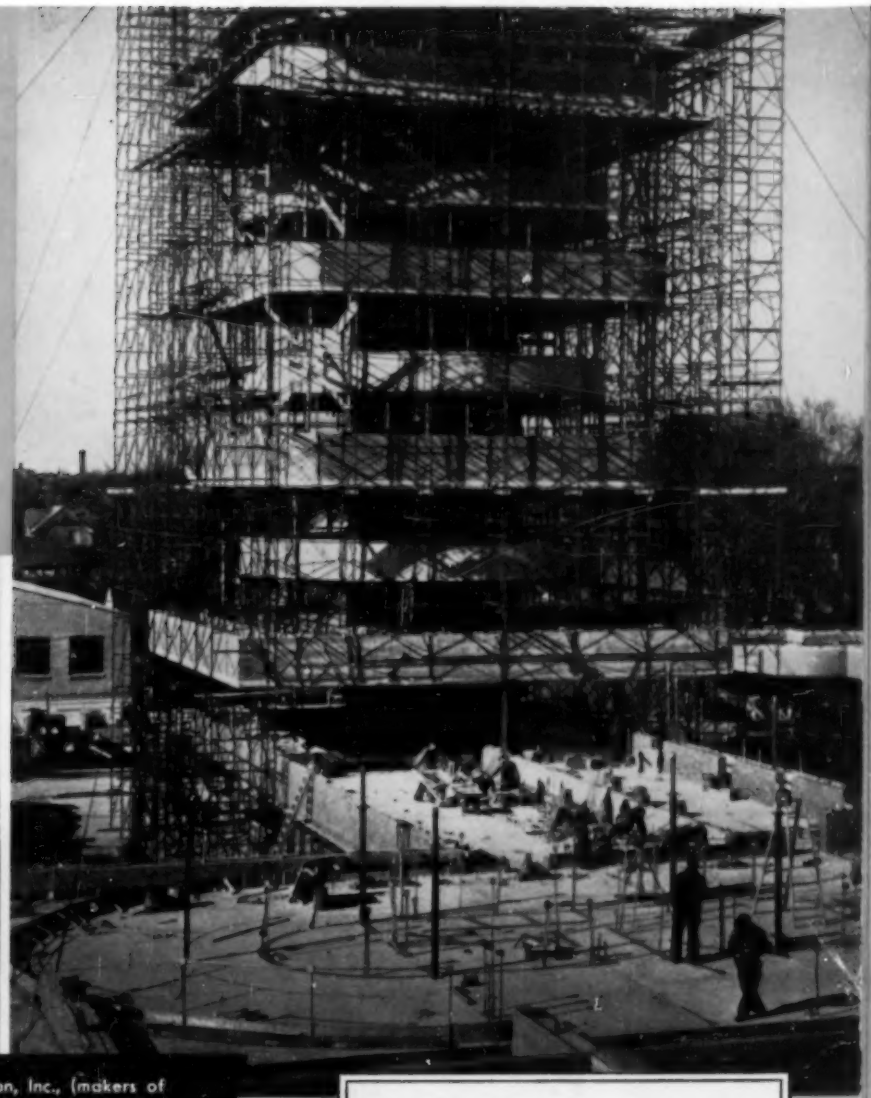
OZZOLITH ONCRETE IN ltra-Modern esearch Tower



Research and Development Tower, S. C. Johnson & Son, Inc., (makers of Johnson's Wax) Racine, Wisconsin. Archt.—Frank Lloyd Wright, Spring Green, Wisc.; Contr.—Wiltscheck & Nelson, Racine, Wisc.; Pozzolith Ready-Mixed Concrete furnished by Consumers Co., Kenosha, Wisc.

se of Pozzolith Concrete in many of America's most modern structures, ke this research and development tower of S. C. Johnson & Son, Inc., evidence of its exceptional performance.

ost-wise, too, the results with Pozzolith are outstanding because what- er the concrete qualities, they can be obtained more economically ith Pozzolith than by any other means.

n 1948 alone, over five and one-half million cubic yards of Pozzolith oncrete were placed because of such benefits as:

- IMPROVED WORKABILITY WITH *LESS* WATER
- MINIMIZED BLEEDING AND SEGREGATION
- REDUCED SHRINKAGE
- ASSURED STRENGTH
- GREAT DURABILITY
- REDUCED PERMEABILITY

ozzolith conforms with the water-cement ratio law — basis of ACI nd ASTM procedures for the design, specification and production of oncrete.

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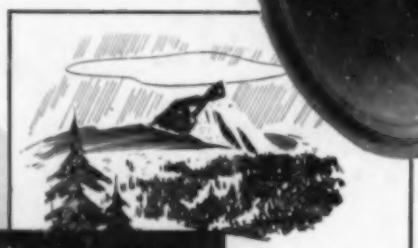
LOCK JOINT REPEAT PERFORMANCES

DETROIT—Since 1942
13 jobs—Totalling
186,950′ of 24″-72″ pipe

WASHINGTON D. C.—Since 1925
16 jobs—Totalling
117,510′ of 20″-78″ pipe



DENVER — Since 1920
24 jobs — Totalling
501,302′ of 20″-90″ pipe

NORFOLK—Since 1921
17 jobs—Totalling
511, 547′ of 20″-54″ pipe

Why do they all choose Lock Joint Pressure Pipe —again and again—for their major water supply projects?

THERE ARE FOUR MAIN REASONS

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